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Eighteen-Inch Shaper.

We present on this page an illustration of a shaper which possesses some notable features, especially in the combination of the Whitworth quick return and the slotted lever, by means of which the rapidity of the backward stroke is practically doubled as compared with what it would be, if either one of the "quick return" devices were used by itself. At the same time, by proper location of the various centers of motion, an unusually uniform motion is obtained during the cutting stroke.

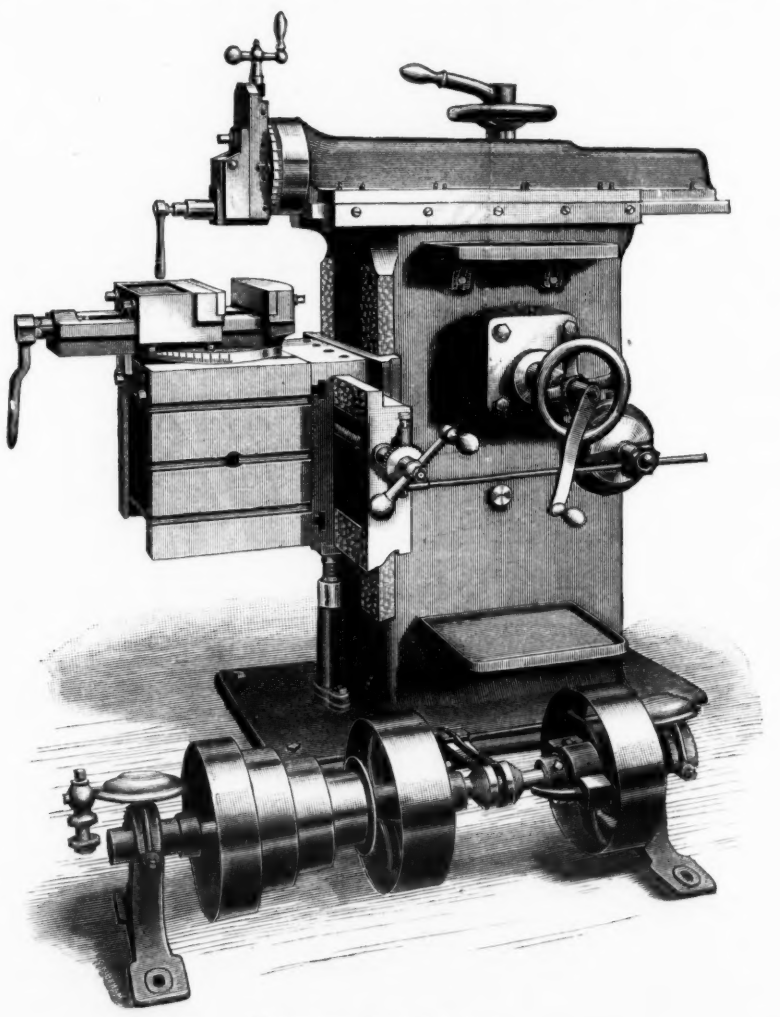
There is an outside index which shows what stroke the ram will make, and this is set by the hand crank seen at the right of the column; the hand wheel seen in conjunction with it clamping the parts in place when set. The slotted lever is so made that it can be readily adjusted to compensate for wear.

By the small hand wheel seen on top of the ram a pinion is turned, this pinion engaging with a rack, and thus the block to which the connecting link is attached is moved along the ram for adjustment, and this can be done when the machine is in motion.

Reference to the engraving will show that the shaper possesses other features of modern practice, including a box table with facilities for fastening vise to the side, if necessary, and the box can also be removed and work or special fixtures attached directly to the saddle.

There is a four-speeded cone for a 2½-inch belt, and with the double friction clutch countershaft eight speeds are provided for.

The machine planes 18 inches long, 20 inches wide and 15 inches high. The ram is 42 inches long, 8¼ inches wide, and has a bearing in the column of 26 inches. Vise has jaws 11 inches wide, 2¼ inches deep, and they will open to 8½ inches. The down feed of the tool is 6 inches. The shaper weighs 2,000 pounds, and is made by the Mark Flather Planer Co., Nashua, N. H.



EIGHTEEN INCH SHAPER.

Electric Lighting by Wind-mill Power.

A correspondent recently inquired about apparatus for electric lighting by a wind-mill, and it might interest readers to learn something of what has been done in that direction.

A mechanic who has not made a special study of electrical machinery has only the indefinite idea that a dynamo is a machine which, if driven by some kind of power, will make electricity. He has learned that there is such a thing as a storage battery or accumulator, which is something that can be filled full of electricity from a dynamo, and which can then be kept on tap, so that it can be used when wanted for electric lighting or running motors. He, of course, knows what a wind-mill is, and it is the most natural thing in the world for him to think that, as wind does not cost anything, all that is required is to hitch the wind mill to the dynamo, and the dynamo to the storage battery, and then he can tap that and have his lights for just next to nothing. This has been done several times by different people who had the money and the ability to make the plan a success, and, although it is an electrical and mechanical success, it has not, I believe, reached the commercial condition wherein such a combination, complete and ready for use, is offered to the public.

The difficulty at present is the high first cost, and the cost of maintenance. At the light end of the problem the requirements are very rigid. The electric current must be ready to use any time when needed, the supply of electric current must be constant, and its force must not vary over two per cent. from the normal.

At the other end of the problem exactly opposite conditions are found. According to observations made by the U. S. Signal Service, the average velocity of wind observed at 14 different stations was equivalent to 16 miles per hour for 8 hours per day; but, although the time per day is a large average, both the hours and velocity are so variable, that the size of accumulator required costs more than double the cost of the dynamo.

To see the further difficulties involved, it will be necessary to explain briefly the character of electric action, in a way that the novice can comprehend it.

It was discovered that by moving a wire past the pole of a magnet it produced an electric force in the wire that would cause a current of electricity in it if the two ends of the wire were connected, so that there was a complete circuit or path for it. In a dynamo the same thing is done by having a cylinder revolved between the poles of a magnet, the cylinder being covered by wires in which the electric force is to be produced. Its action may be compared to that of a revolving fan or blower, such as is used to force air into a cupola. If the discharge opening of the fan is closed while running, it does not discharge any air, but it does produce a pressure, which at a constant speed does not vary, but by varying the speed the pressure may be varied. Electric pressure is measured by a unit called a volt. A dynamo, similar to a fan, if run at a constant speed, will generate a certain electrical pressure in the wires on the cylinder.

If a fan were discharged into a pipe which led around and entered at the air inlet of the fan, it would form a complete circuit for the air, so that the same air would be used repeatedly. Similarly in a dynamo when the two ends of the wire on the revolving cylinder or armature are united together, this completes the electric circuit, and the current continues to flow as long as there is any pressure. If the wire is broken or opened by a switch the current stops, and this corresponds to a gate or valve in the fan pipe, which on being shut stops the air from flowing through the pipe.

The operation of a fan is not perfectly analagous to a dynamo, for there is no actual flow of electricity along the wire, but it is supposed to be transmitted by vibrations similar to the way light and sound are transmitted through space.

The rate of transmission of an electric current is measured by a unit called an ampere.

The rate of flow of air through the fan pipe may be measured by taking the cubic feet of air passing per unit of time, and knowing the pressure, it is easy to tell the amount of power transmitted. In a dynamo, if the pressure in volts, and the rate in amperes are known, then the power transmitted is calculated from this. These two electrical units are arbitrary quantities established for convenience in measuring and calculating electrical forces, and their relative size compared to a horse-power is such that it takes 746 volt-amperes to equal one horse-power. Or to make it plainer, if there is 100 volts pressure, there must be 7.46 amperes velocity to equal one horse-power; that is, the volts × amperes must always equal 746. The voltage of a dynamo may be varied by changing the speed, or by changing the strength of the magnets.

When a dynamo is driven by a wind-mill the speed will vary between wide limits, and unless some method of regulation is used, the voltage will vary with the speed.

An accumulator is made up of a number of secondary chemical cells connected together, and the number of cells needed depends on the voltage required.

For incandescent lamps in a building where cost of wire is at most a small item, 50 volts is commonly used, and this requires about 20 to 24 cells, according to kind used.

The dynamo which charges this must not decrease in speed enough to allow the pressure to fall below 50 volts, for if it does, a current will commence to flow back from the accumulator through the dynamo. This is caused by the voltage of the accumulator, which remains near 50, and if the dynamo falls below that then the accumulator forces a current back through the dynamo. On the other hand, if the speed of the dynamo increases very much, the voltage gets so high and the accumulator is charged so rapidly that it unduly heats the cells, causing waste of chemicals, and possible injury to the plates. Between these limits only can it be used, and to accomplish this there must be provided automatic circuit breakers to stop the current at these extremes, and connect it again when the speed gets within the limits. Another way used to obviate the difficulty is to vary the magnetism of the dynamo fields in proportion to the speed changes, so as to keep the pressure constant. This requires a special dynamo, with magnets and windings sufficient to give the poles the greatest magnetic intensity at the slowest speed, and the result is that when running at the maximum speed the strength of the poles must be at the minimum, and they are much larger than is needed at that speed. It is also possible to use some sort of differential speed arrangement that would keep the speed of the dynamo constant while the wind-mill varied.

With any plan used it is necessary to have the automatic circuit breaker that will open the circuit when the lower limit of dynamo speed is reached, and no matter how low this limit may be fixed at, it is still necessary, for the wind-mill sometimes stops.

No matter what arrangement is adopted,

it is apparent that there is quite a lot of mechanism needed which is not only somewhat expensive, but also requires considerable attention to keep it all in good working order.

For an outfit for 6 lamps of 16 candle power each, used 4½ hours each day, which is equal to 27 lamp hours, it will require nearly one horse-power. The cost of this, complete, will be from $500 to $700, according to quality of apparatus, and location.

Taking the interest on investment, depreciation, oil and attendance, the expense for each lamp per hour will be from ½ to 1 cent, and any one knowing how many lamps are wanted, and the time they are required to be in use, can easily figure out whether they wish to enjoy the luxury of electric light made by free wind. For a plant of 60 to 80 lights, the economy is about 50 per cent. better.

No doubt in time some of the obstacles will be overcome, but that is the present condition of affairs, and it explains why it is that nobody is doing a rushing business supplying outfits of this kind.

There are petroleum or gasolene engine builders who will guarantee their engines to develop a horse-power per hour for 1 cent, and as no accumulator would then be required, it would be fully as cheap as wind power.

BELL CRANK.

Spacing Holes—III.

BY EASY WAY.

As to the "micrometer" face plate with two movements at right angles to each other, if it were made to cover much of a field, say, 6 inches square, it could hardly go on a face plate smaller than 18 inches, probably not less than 20 inches diameter; and I think it would be easy to write charges footing up to a thousand dollars against such a job before it could be relied upon to locate holes inside of a thousandth limit on the diagonals; and I do not expect to see such a tool in general use. As a possible substitute for the "micrometer" face plate, I suggest a face-plate spacing fixture to be used in connection with plug gauges, all as shown in Figs. 20, 21, which may possibly prove a cheap and useful tool. It is new to me, though, of course, it may be known to others.

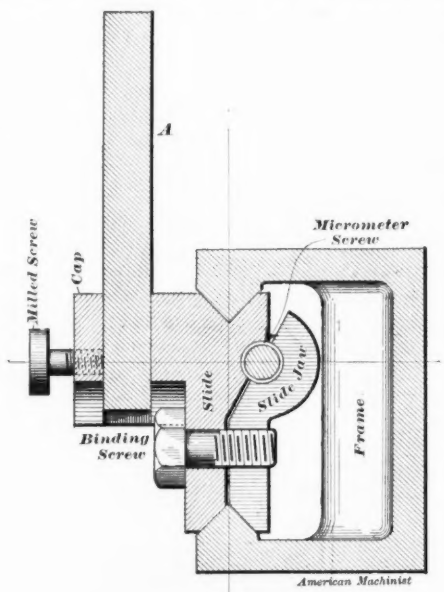
It is convenient to have a micrometer read to both the binary and decimal divisions of the inch for shop use, and the spacing screw should be as coarse a pitch as can be well used for the sake of speed. Eight per inch is the natural pitch for binary divisions, and 10 per inch for decimal divisions. If an 8 per inch screw is used, the index circles would have 80 and 125 spaces respectively; 5 is the greatest common divisor of 80 and 125, hence there would be only 5 coinciding lines of the two indexes, and these ⅕ of the circle spaces would represent $\frac{1}{40}''$ nut advance, which is not the most favorable division of the inch for direct even translation of the micrometer readings from the binary to the decimal system. But the 80 index circle would read 8ths, 16ths, 32ds, 64ths and 128ths on the even lines, and a single space of the index would read $\frac{1}{10}$ of $\frac{1}{64}''$, which makes an excellent binary division of the inch of nut advance; the 125 space index circle would read in thousandths for each space, of course, $\frac{1}{125}$ of $\frac{1}{8} = \frac{1}{1000}$.

With a 10 per inch screw, the index circles would have 80 and 100 spaces, and each space of the 80 circle would represent $\frac{1}{800}$ of an inch nut advance, and 50 spaces revolution of the index would give $\frac{1}{16}''$ nut advance; one turn of the index would give $\frac{1}{16}'' + \frac{50}{800}''$, and this latter fraction equals $\frac{3}{800}' = \frac{3}{8}''$ of $\frac{1}{16}''$ nut advance, which is an awkward division for numbering on the 80 index circle. One turn of the 8 per inch screw would give ⅛″ nut advance for the binary reading, and 0.125″, or 1¼ tenths for the decimal reading, which is much more convenient for the index numbers, as the 5 index lines common to the 80 space and the 125 space circles of graduation could then be each numbered 25 on the thousandths index circle as they would represent 0.025″ nut advance, and the 80 circle could be numbered $\frac{1}{8}\frac{1}{4}$ at each tenth division, and cut with a long fifth line, between which would be the index for $\frac{1}{128}''$ of nut advance, while the common zero line for the two index circles could be numbered 0¼ and $0\frac{1}{16}$ for the respective circles. It therefore appears that an 8 per inch screw gives the easier index readings, and as it is quicker in action than the 10 per inch screw, the use of the 8 per inch screw would appear correct.

It is, of course, essential to establish and maintain an unvarying end position for both screw and nut, and it is also desirable to leave the non indexed end of the screw free; this requirement at once suggests the wedge, as the split nut and clamping screw give a defined wedge retained position to the nut if the screw have a V or standard thread, and a single cone journal for the screw, with a pinching screw, also locates the screw position endwise definitely with reference to the frame of the spacing fixture. And as this fixture must be delicately used to make its results at all reliable, milled heads are sufficient to turn the clamping screws. Not only must the nut be secured to the screw, and the screw to the frame, but the nut must also be secured immovably to the frame of the spacing fixture. This result is also obtained by making the nut slide on two V-ways formed in the frame, as shown in the drawings, so that the nut clamping screw serves both to bind the nut to the screw and to the frame by the one movement, as shown in Fig. 21. The top of the nut is fitted with a box seat and three milled head screws to retain and secure the plug hole plates *A*, which must contain all sizes of holes from, say, an inch down, as the limited size of the face plate of a toolmaker's lathe, not exceeding about 16 inches in our American practice, will not make this device available for a series of holes much above 1 inch diameter. The face plate is provided with a series of index screw holes are 1 inch apart in the face plate, so that all positions can be covered), then slip a plug plate *A* into the seat in the fixture, and adjust it with the index screw and the holding screws until the plug will pass perfectly through the plug plate into the bored hole in the work; take a reading of the screw index, then loosen the work, and move it along on the edge of the fixture with the index screw the required distance, clamp the work, remove the plug and plug plate, and proceed with the next hole.

I think that, given a good 16 inch lathe, a block 8 inches extreme length could be bored with a straight row of holes having considerably less than one-thousandth variation in their center to center distances *in careful hands* Perfect cleanliness and a delicate touch would be needful, but as correctly spaced holes are often called for, and as this fixture is comparatively simple, it may be found of use. As I said, it is new to me, though it may be well known to others.

The extreme thickness of the work would be from the face plate out to the inside of the plug plate, and the work would need to be blocked out with parallels on the face plate to *almost* touch the inner side of the plug plate, so as to have as little space as possible between the plug plate and the work at the time the plug is passed through the plate into a finished hole preparatory to spacing for the next hole.



Section, Showing Slide Binder Construction

Fig. 21

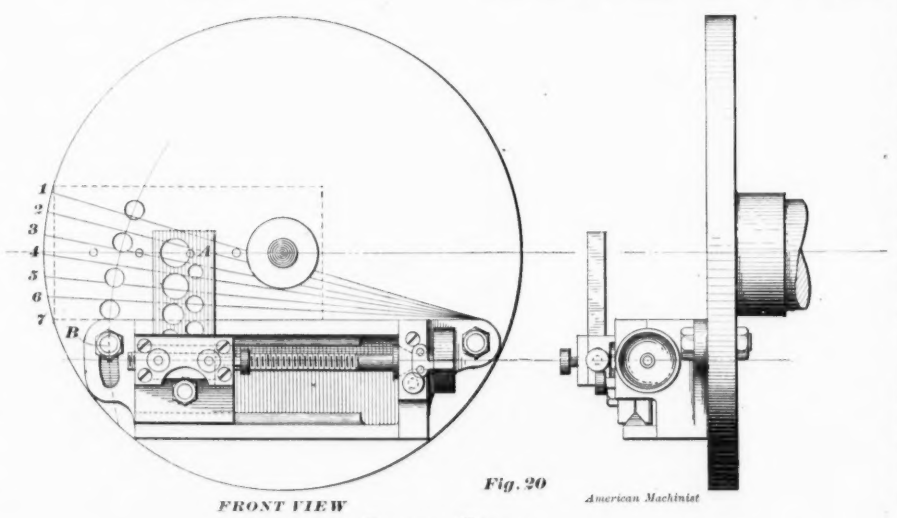


Fig. 20

SPACING HOLES.

It is well to say here that few machinists have ever handled a set of accurate plug and ring gauges, and that it is quite out of the question to use such precise instruments in ordinary shop practice, even if their precision would endure under constant service. It requires a good deal of practice to enter a plug gauge in a ring which really fits it, and it is no unusual occurrence for a perfectly fitting plug and ring to be returned to the makers with the assertion of some master mechanic or foreman that it is impossible to put the plug into the ring. All plug and ring-gauged machine fits are consequently over and under size, and positively accurate sizing is unknown in ordinary shop practice. I make these statements here as otherwise what I say might lead those who are well informed to think me ignorant, and might also lead the many excellent workmen who are not familiar with really good plug and ring fitting to think that it is needful only to have a set of perfect plug and ring gauges to do perfect work. Such is not the case. A *perfect* set of plug and ring gauges is seldom or never turned out by any maker whatever, and a set of plug and ring gauges which are close to right, are of use only as ultimate standards of comparison; they are not fit for shop use at all. A plug and ring gauge for shop use must be so far from corresponding in diameter that the plug will enter the ring dry, when both are clean, or with no more lubrication than is due to wiping with clean fingers, which are really never clean, and leave a film on everything they touch. A plug and ring for shop use must also vary so much in size that they will go together at slightly varying temperatures, and so much that the plug can be placed in the ring and left there without any danger of sticking fast. It is because of this indispensable lack of accuracy in plug and ring gauges for shop use that a sensitive touch must always be the ultimate indispensable factor in close work. The closest fitting must always continue to be exactly what it was before the day of accurate "dead to size" shop measurements, a matter of touch, in which the fingers of the workman estimate small fractions of a thousandth of an inch difference in sizes. I am not sure of the very latest shift of opinion among the highest grade workmen, but I believe I am safe in saying that an old-fashioned pair of spring calipers can be found in daily use in the hands of the fine plug and ring gauge makers, and that in their sensitive fingers the spring calipers detect differences as certainly as any tool ever used, and much more readily than any other.

Hence in the plug block shown in Fig. 20, the holes to receive the plugs must be over size, so that the "standard" or shop "standard" plug will slide freely in its corresponding hole in the block, and it will always be needful to depend solely on delicacy of touch for any close approach to accuracy in hole spacing by the use of such a face-plate fixture as is shown in Figs. 20, 21.

The section, Fig. 21, shows how the single binding screw tapped in the slide jaw is arranged to tighten the slide on the frame Vs, and also on the micrometer screw by a single action.

Plates of Uniform Strength.

BY ALBERT E. GUY.

SECTION 9—CONTINUED.

Third method.—The reaction of the support of the plate is (Fig. 15):

$$P = \pi R^2 p.$$

The bending moment about a circumference of radius r may be expressed as follows:

(79) $$M = P l - Q$$

The center line of gravity of the load—as

found in paragraph 2—is a circumference of radius = 0.7071 R. The maximum bending moment is produced about this line, for it is the application in place of the resultants of the forces acting on the plate (see paragraph 8).

A diametral section of the plate looks like a longitudinal section of a beam supported at the ends. If we represent the resultants of the forces by the arrows Y and Y', the beam appears to be loaded at two points similarly distant from the supports, in which case the bending moment is zero at the supports, increases to a maximum at Y and Y', and is constant along 2 r_0.

The moment about any point a or a' is equal to (the reaction of one support $\times$ l) — (the total load along $l \times n\, l$); $n\, l$ is the distance from a to the center of gravity of the load supported along l.

The equations for determining the values of n are given in paragraph 5. It may be well for convenience sake to present them briefly here, with a more complete table of these values.

Half the area of the plate limited by circumferences 2 π R and 2 π r equals $\pi (r+x)^2 - \pi r^2$.

$x = n\, l$ and circumference $2\pi(r+x)$ is the center line of gravity of the load distributed along l.

$R = r + l$.

$$\frac{\pi (r+l)^2 - \pi r^2}{2} + \pi r^2 = \pi (n\, l + r)^2 = \pi (r+x)^2.$$

whence:

$$2r + l = 2 n^2 l + 4 n r.$$

$$\frac{2r+l}{2l} = n^2 + \frac{4 n r}{2 l}.$$

$$n = -\frac{r}{l} \pm \sqrt{\frac{2r+l}{2l} + \frac{r^2}{l^2}}.$$

But as $x = n\, l$

$$(42)\quad x = l\left(-\frac{r}{l} \pm \sqrt{\frac{2r+l}{2l} + \frac{r^2}{l^2}}\right)$$

$$= -r \pm \sqrt{\frac{2rl + l^2}{2} + r^2}.$$

In the following table will be found values of n for different ones of r and l expressed in terms of R. In the last column, $x = n\, l$ is also in terms of R:

$$R = l + r = 1.$$

l	r	n	$x = n\, l$
1.00	0.	0.7071	0.7071
0.95	0.05	0.693	0 658
0 90	0 10	0.678	0 611
0 85	0.15	0.664	0.564
0.80	0.20	0.651	0 521
0 75	0.25	0.638	0 479
0.70	0 30	0.626	0 438
0.65	0.35	0 614	0 399
0.60	0 40	0.603	0.361
0.55	0.45	0 591	0 325
0.50	0.50	0 581	0.290
0.45	0 55	0.569	0 25
0.40	0.60	0.562	0.225
0 35	0 65	0 552	0 193
0 30	0.70	0.544	0 163
0 25	0 75	0.535	0 134
0 20	0 80	0 528	0.105
0.15	0 85	0 52	0 078
0.10	0 90	0.513	0.0513
0.05	0.95	0 506	0.0253
0.	1.00	0.	0.

Then equation (79) becomes:

$$P\, l - \varphi = M = (\pi R^2\, p\, l) - (\pi R^2 - \pi r^2)\, p\, x$$

But

$$M = f \frac{b\, h^2}{6} = f \frac{\pi}{3} r\, y^2. \quad (b = 2\pi r)$$

$$(80)\qquad M_{max.} = f \frac{\pi}{3} r\, h^2.$$

hence:

$$p\,(R^2 (l - x) + r^2 x) = f \frac{r}{3} y^2.$$

The maximum thickness h is along circumference $2\pi(0.7071\ R)$ corresponding to the maximum bending moment as before stated. It could be demonstrated that this moment is constant along radius = 0.7071 R by considerations similar to those employed in paragraph 8.

The thickness at any point a along l is

$$(81)\quad y = \pm \sqrt{p \frac{(R^2 (l-x) + r^2 x}{f} \cdot \frac{3}{r}}.$$

The maximum thickness

$$h = \pm \sqrt{\frac{p}{f}\left(R^2 (0.2929\ R - 0\ 163\ R)\right)} + \sqrt{(0.707\ R)^2 (0.163\ R) \cdot \frac{3}{0\ 7071\ R}}$$

$$(82)\quad h = \pm \sqrt{0.895 \cdot \frac{p\, R^2}{f}} = \pm\ 0.946\ R \sqrt{\frac{p}{f}}.$$

h is uniform along radius = 0.7071 R and gradually diminishes in value from (82) to zero at the edge of the plate.

$$(83)\quad \text{The stress } f = \frac{0.895\ p\ R^2}{f\ h^2} = \frac{p}{f} \cdot \frac{3}{r} \cdot \frac{(R^2 (l-x) + r^2 x)}{y^2}.$$

The load per unit of area

$$(84)\quad p = \frac{f\, r\, h^2}{3\,(R^2 (l-x) + r^2 x)} = \frac{f\, h^2}{0.895\ R^2} = 1\ 117 \frac{f\, h^2}{R^2}.$$

Comparing the three methods, we have for the value of h

Professor Grashof.	Professor C. Bach.
$= 0\ 913\ R \sqrt{\frac{p}{f}}$	$= 0.933\ R \sqrt{\frac{p}{f}}$
	from experiment.

Formula (82)

$$h_{max.} = 0.946\ R \sqrt{\frac{p}{f}}.$$

In the following is developed a method given in embryo in Thomas Box's work on "Strength of Materials," where it is partly

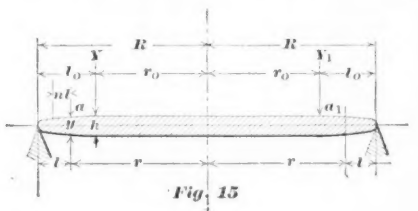


Fig. 15

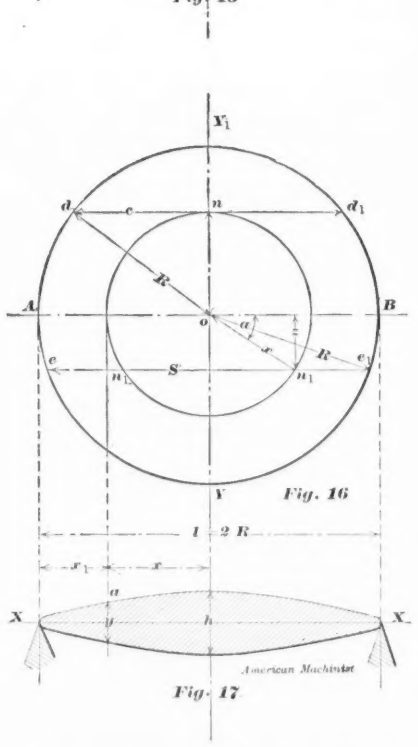


Fig. 16

Fig. 17

used for calculating the thickness of cylinder bottoms, and which, on account of its plausible appearance, is completely misleading, since by it excessive dimensions are determined for the plate. The question thus treated presents a curious aspect.

In Fig. 17 is shown the longitudinal section of a beam of uniform strength, supported at the ends and loaded uniformly. The equation expressing the bending moment at any point a may be taken from Professor Reuleaux's Constructor, § 6, case VIII., viz.:

$$M = \frac{P\, x_1}{2}\left(1 - \frac{x_1}{l}\right).$$

P is the total load, and if b is the breadth of the beam, $P = b\, p\, l$. Since p is the load per unit of area, let us make $b = 1$, then,

$$(85)\qquad M = \frac{p\, l}{2}\, x_1 \left(1 - \frac{x_1}{l}\right)$$

$\frac{p\, l}{2}$ is the reaction of each support, and M is composed of the moment about a, or $\left(\frac{p\, l}{2}\right.$ multiplied by $\left.x_1\right)$, diminished of the moment $p\, x_1 \cdot \frac{x_1}{2}$, for equation (85) may be written,

$$M = \frac{p\, l}{2} \cdot x_1 - p\, x_1 \cdot \frac{x_1}{2}.$$

The longitudinal section is elliptical, and the equation for finding the thickness corresponding to a uniform stress f at any point a is given in Unwin's Machine Design, Vol. I., page 71.

The transverse section of the beam being rectangular, the thickness

$$(85_2)\qquad y^2 = \tfrac{3}{4} \frac{p}{f\, b}\,(l^2 - 4\, x^2).$$

This value is obtained by substituting for x_1, in equation (85), its equivalent $\left(\frac{l}{2} - x\right)$.

$$M = \frac{p\, l}{2}\left(\frac{l}{2} - x\right)\left(1 - \frac{\frac{l}{2} - x}{2}\right)$$

$$M = p\left(\frac{l^2}{8} - \frac{4\, x^2}{8}\right) = f\, \frac{b\, h^2}{6} = f\, \frac{b\, y^2}{6}.$$

Whence

$$\frac{6\, p}{8}\left(\frac{l^2 - 4\, x^2}{f\, b}\right) = y^2 = \frac{3}{4} \cdot \frac{p}{f\, b}\,(l^2 - 4\, x^2).$$

Above the longitudinal section of the beam, in Fig. 16, is drawn the top view of a circular plate supported at the edge, uniformly loaded, and having a diameter = 2 $R = l$.

Conceive now, this plate as composed of an infinite number of laminæ parallel with the diameter A B, each acting like a rectangular beam. The diametral section is similar to the longitudinal section of the beam.

It will be demonstrated that such a plate is an ellipsoid of revolution, *i. e.*, is a solid generated by the revolution of a semi-ellipse about axis Y Y_1.

From center o, with a radius = x, describe a circumference.

The bending moment about a we have found to be

$$(86)\qquad M = \frac{p}{8}\,(l^2 - 4\, x^2),$$

must equal the bending moment about any point of a lamina intersecting circumference 2 π x. Let us consider lamina $d\, d_1$ tangent to 2 π x, and of length = c. The moment about point of tangency n is

$$m = \frac{p}{8} \cdot c^2.$$

Since n is the center of the lamina, $x = o$ in equation (86).

Joining d_1 and o with a radius R, we have:

$$\frac{c^2}{4} = R^2 - x^2.$$

$$c^2 = 4\, R^2 - 4\, x^2 = l^2 - 4\, x^2,$$

because:

$$4\, R^2 = l^2.$$

Hence:

$$m = \frac{p}{8}\,(l^2 - 4\, x^2) = M.$$

For any other lamina $e\, e_1$ of length S, the bending moment for point n_1 is:

$$m_1 = \frac{p}{8}\,(S^2 - 4\, z^2).$$

Joining e_1 and n_1 respectively to the center, we have:

$$\frac{S^2}{4} = R^2 - (x \cos.\ \alpha)^2.$$

$$S^2 = 4\, R^2 - 4\, x^2 \cos.^2 \alpha = l^2 - 4\, x^2 \cos.^2 \alpha.$$

$$z = x \sin\ \alpha.$$

$$4\, z^2 = 4\, x^2 \sin.^2 \alpha.$$

$$S^2 - 4\, z^2 = l^2 - 4\, x^2 \cos.^2 \alpha - 4\, x^2 \sin.^2 \alpha.$$

$$- x^2 \cos^2 \alpha - x^2 \sin^2 \alpha = - x^2;$$

hence:

$$S^2 - 4\, z^2 = l^2 - 4\, x^2;$$

and

$$m_1 = \frac{p}{8} \cdot (S^2 - 4\, z^2) = \frac{p}{8} \cdot (l^2 - 4\, x^2) = m = M.$$

Consequently, all the diametral sections are similar, the thickness is uniform along any circumference, any circumference is an isodynamic line or line of uniform strength, and the solid is an ellipsoid of revolution.

Reverting to formula (85_2) expressing the thickness, we may substitute for l^2 its value, 4 R^2, and as $b = 1$,

$$y^2 = \frac{3}{4} \frac{p}{f}\,(4\, R^2 - 4\, x^2) = 3 \frac{p}{f}\,(R^2 - x^2)$$

At center, where $x = o$,

$$y^2 = h^2 = 3 \cdot \frac{p}{f} \cdot R^2,$$

and

$$h = \pm \sqrt{3 \frac{p}{f} \cdot R^2} = \pm\ 1\ 732\ R \sqrt{\frac{p}{f}}.$$

This value is excessive when compared with those found by the other methods.

It is true that it varies radially from this to zero, but along a circumference of radius = 0.7071 R, the thickness is still greater than necessary, viz.:

$$y^2 = 3 \cdot \frac{p}{f}\left(R^2 - 0\ 7071\ R^2\right).$$

and $y = \pm \sqrt{1.5\ R^2 \frac{p}{f}} =$

$$\pm\ 1.224\ R \sqrt{\frac{p}{f}}$$

It is, of course, evident that these formulæ can be made to agree with the results of experiments by introducing in them a coefficient which would account for the forces of cohesion of the laminæ. But even then this expedient would not correct matters, since the thickness would still be greatest at center, and we have found that it should be uniform along the diameter of the center line of gravity of the load.

Making Pin Machines.

BY GEORGE GUNTZ.

The manufacture of brass pins was a process at one time very closely guarded from the eyes of the public at large, and from those of the machinist particularly, for fear that they might get an idea of how the thing was done, take mental patterns of the machines, and go into the business. I think the foolishness of trying to keep manufacturing processes and machinery secret has pretty well fizzled out, yet there are a great many establishments which do not particularly care to let one see how they do things.

To show how useless it is to try to keep such things secret, I am going to tell how, in the fall of 1879, the design of a machine for making brass pins was stolen. In the sixties—and I believe as late as '72—there was a pin factory in Cohoes, N. Y., and Johnny McCreary had something to do with the machinery. In 1879, he had a little machine shop where he made sinkers for knitting machines, repaired sewing machines, and did such jobbing as his facilities would allow—the facilities consisted of a 16 inch by 4 foot bed, chain feed lathe, a 24 inch by 24 inch by 4 foot planer, a small hand lathe, a small forge and a screw press. I had been at work for the Cohoes Iron Foundry and Machine Co. doing some work on cotton machinery. I had got through with the job, and, having nothing to do, I dropped into Johnny's, and after a little conversation he told me that he had got an order for ten pin machines, but he was quite a little puzzled as to how he was going to get through with the job, as the machines were to be of a special kind, just like a set then in operation in Rochester, but he had no patterns or drawings, and the worst of it was that he had never seen the Rochester machines, and the only person he knew who had seen them was the man who was running them. Johnny had, however, seen this party, and had got a verbal illustration of the machines, but this was rather a poor design to build a machine from, especially as Johnny was no draftsman, neither was the man in Rochester, but he was glad that I dropped in—and was out of a job—as I was just the man he wanted. I could put the thing together on paper sufficient so that a start could be made, and we could pick up the balance as we went along. Well, we started in, and I got the bed on the legs, the driving shaft and header post located, and then Johnny made the patterns, while I made some more pictures (from our imagination), which were found to be pretty near the thing, and with the necessary alterations (which were made in the making of the patterns) were just

right, usually after an appeal to the man in Rochester. Now, this man never wrote us a line, but he was a very practical fellow. Whenever we required any information in regard to a particular part of the machine, he would give it to us in this fashion: He would think the particular piece needed to be taken off the machine to be examined, and he was particular to lay it on a nice clean piece of paper; he was also particular that the piece should be very greasy and dirty, so after he had looked it all over carefully by laying all the flat sides on the paper in different places, the paper was pretty well mussed up with grease and dirt. Now, as the paper was dirty it was no use in the shop, so to save the sweeper some trouble, he kindly took the paper home, and a few days after I was fixing it up for a drawing, and Johnny was correcting the pattern. In the meantime, we got a 86 inch by 12 foot lathe from George Gage, in Waterford, and when the castings commenced to come from the foundry, I run the chain feed lathe and the planer, and Ed. McCreary run the big lathe, and in 76 days we had one machine complete and in running order, making 240 pins per minute, and the largest part of the other nine pretty well along, so that the whole lot were ready for shipment in less than six months from the time I dropped in.

Universal Drawing Table.

We illustrate herewith a drawing table that possesses several good features, among which the spring counterbalancing especially deserves mention, as it relieves all concern as to the table, or drawings that may be upon it, suffering damage through failure of the locking screws to hold under careless handling.

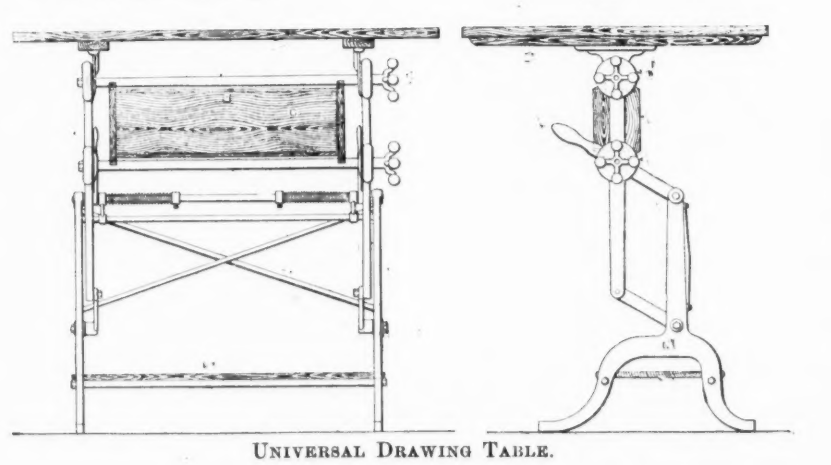
The raising or lowering of the top, which can be placed at from 30″ to 42″ in height, is accomplished by means of the handles shown in the cuts. The inclination of the board can be changed to suit requirements, being held by a frictional clamp, and when the table is not in use the top can be placed in a vertical position for stowage in close quarters.

A receptacle for instruments is attached between the uprights.

The top is made of narrow strips of heavy selected white pine, securely cross-battened, and the legs and uprights are of enameled cast-iron, braced with heavy wrought-iron tubing.

The legs are fitted with castors for easy handling, where the table is not intended for a permanent fixture. Otherwise provision is made to secure to the flooring by screws. The table is made in four sizes from 30″x42″ to 42″x72″, and the weight, complete, ranges between 75 and 105 pounds.

It is made by L. E. Hoyt & Co., Walton, N. Y.



UNIVERSAL DRAWING TABLE.

Doings at Backaway.

SEVERANCE TRIES HIS HAND AT STEAM ENGINEERING.

Mr. Editor.—Somehow there is an attraction at Backaway that has brought a good many manufacturers here since I became a resident; there has even been some talk of changing the name of the town. However, Severance moved his business, which he had inherited from his father—moved it to Backaway—about four years ago. The business is making bagging, and Severance the elder had been engaged in it for a good fifty years, or more.

The younger Severance came to Backaway, and his business grew steadily; slowly but surely, till last year he had to put in a new boiler. So much steam used about the mill that the old one failed to respond to the calls made on it.

Severance had his boiler inspected and insured, the inspector passing it for a pressure of 80 pounds, and setting the safety valve accordingly.

Everything went along smoothly for three years, till Severance picked up an English paper in which was an account of an engine that was doing a horse-power on 1½ pounds of coal.

I ought to have told you before this something about Severance. He is just one of the best fellows in the world. He knows all about the bagging business; knows it at the beginning and the end, and all through its intermediate sections. But he is troubled with spasmodic imagination that he is out of his place; ought to have been an engineer. Severance thinks he should have planned and constructed steam engines and the like instead of managing the bagging business.

Just that, Mr. Editor, I imagine, troubles a good many of us more than we are willing to admit; think we are just exactly out of our place, and struggling, more or less, to get into it. We may have a desire to work at things all the world may see, or we may want—as I heard one man say—to become a "Steeple Jack," because then no one can inspect our work.

Here was Severance's opportunity to show his ability as a steam engineer. He always had a mild idea that the general mechanical department of the works would go speedily to pieces without his fostering care, but somehow he had never had an opportunity to show his skill in the line of steam engineering. Uncle Jack had always attended to that.

Uncle Jack had been in the employ of the elder Severance, and then the younger, so long, that no one, unless it was the time clerk, and the paymaster, knew his real name, or whether he had any other name than the one he was universally known by around the works. He had worked for the elder Severance while Severance the younger was playing at marbles.

A peculiarity of Uncle Jack's was that he was never known to be in a hurry; never got off his base, as the boys say. Once, in the days of the elder Severance, when the works were located at Onetown, a fire broke out in the lower story, and every one stampeded; every one but Uncle Jack. There was a big water plug in the second—and that was the top—story. This was before the days of fire pumps, and elaborate appliances for putting out fires in mills. Uncle Jack walked leisurely upstairs, turned a full head of water on the upper floor, then walked as leisurely down, and, at a little distance, watched the water do its work. There was nothing very combustible about the mill, and the loss was small. The water Uncle Jack turned on did its duty.

You, Mr. Editor, who have rattled around machine shops here and there, have seen just such men as Uncle Jack working in a kind of general way all over the shop; didn't make any difference to them what the job was, or what machine they were run up against. You have seen such a man when a hurry repair job was rushed right up to him, look exasperatingly cool, shocking all the proprieties of a nervous foreman, and destroying all the hopes of acquiring patience he ever had. You have seen such a man, getting one hand behind him, and the other in his overalls' pocket, stand and look right at the parts and pieces till he had thoroughly satisfied himself where to begin, then you have seen him begin just at the right place, and with never a false move, or anything that could be tortured into an inclination to hurry, lay that work, piece by piece, on the floor; done right, and when you have looked at it you have wondered that it was done so quickly. That's just the kind of man Uncle Jack is in his sphere; always knows just what he is going to do before he begins to do it.

Uncle Jack had managed the engine and boiler, and had incidentally looked after a good many other things for Severance, father and son, for full 35 years, and somehow he kept things moving when they ought to move.

Severance put that English paper in his pocket and started out to wrestle with the motive department; going to reorganize things right away, Severance was.

"Uncle Jack," said he, "what do you understand by a horse power?" Uncle Jack explained, and Severance with a wanted-to-see if you knew expression assented.

"How much coal do you burn per horse-power per hour, per hour you understand?" said Severance. "About four pounds, all told," Uncle Jack reckoned.

"That's just about what I thought," said Severance. "Now here is a paper that contains an account of an engine in England—in England, mind you—that does a horse-power on 1¼ pounds of coal. That is less than one-third of what you burn. How do you suppose it all comes about?"

Uncle Jack thought it might be due to any one of several causes, or to a combination of several causes; could tell better if he were to read the article.

"No use reading it," said Severance, "I've read it all through, and I've been studying up on the subject for some time. It's high steam pressure, Uncle Jack, high steam pressure, and nothing else.

"I didn't suppose you would know because you never seem to get time to think of such things. You men who run steam engines never give enough time to thinking. I've just watched you lots of times, and you seem always to be looking after the fire, or the water, or feeling to see if the crank pins, or the main journals, are hot; when you are not doing this you are looking over the main shaft, or some of the countershafts, or some belt or other. You do this instead of putting on plenty of coal, and water, and oil, and sitting down and thinking; thinking is what counts, Uncle Jack. Somehow the better the engineer the less time he finds to think.

"I'm going to take right hold of the steam department of this plant. I'll tell you what to do and you do it. Save you all the trouble of thinking over it. You just carry 200 pounds steam pressure and all the rest will take care of itself. We will save more than half of our coal bill. Why, Uncle Jack, don't you see that if you divide 200 by 80 you get 2½? Then it stands to reason that 200 pounds pressure will push against that piston just 2½ times as hard as 80 pounds will, and that shows the saving between high and low steam pressure. It's perfectly simple, and if I had only found the time I should have worked it out a long time since; worked it out to the saving of thousands of dollars in coal bills. But the hurried orders that always seem to strike us have kept me busy, mighty busy, Uncle Jack. No trouble to figure the whole thing out if you only have time, and know how.

"The fact is," continued Severance, confidentially like, "I haven't given so much time to steam engineering matters around the mill as I should have given. Didn't take me five minutes to work this coal saving scheme all out when I got the time, and got right down to it.

"When we get this going, Uncle Jack, it will help you and it will help me. I shall save money and you will have less than half the coal to shovel you do now. Give you more time to get that southeast shaft in line. We might put a lathe over in that corner and you could turn up lots of those pieces we have to send over to Benson to be turned. Take it kind of easy like with the coal pile cut right in two, and you working at the smallest part, couldn't you?"

Uncle Jack had heard Severance talk before. One time he wanted him to put a pump in the engine room and lift water 45 feet from the river, and when Uncle Jack insisted that no pump could lift water that height, Severance proposed putting two pumps on the same suction.

Uncle Jack knew pretty well what was to come, so he looked at his fire and water and resigned himself to the inevitable, with all the philosophy of a man who has to do something there is no use doing.

"Mr. Severance," said Uncle Jack, when he got a chance to talk, "that boiler was built, inspected and insured to carry 80 pounds pressure. That is all the pressure it is considered safe to carry on it. If you order 200 pounds, I hope you will give me sufficient notice to enable me to get into the next town before it goes on."

"Hang it," said Severance, "this boiler I am speaking about was built in England, and used in England, and if a boiler will stand 200 pounds in England, it will stand 200 pounds here. A boiler is a boiler, no matter where it is put together, and 200 pounds in England is just the same as 200 pounds in the United States."

There wasn't any disputing this; but Uncle Jack felt called upon to explain the difference between boilers; different boilers had different capacities in all directions.

Uncle Jack's explanation rather run up against Severance; staggered him just for a minute or so.

"When Risdon built that boiler," said Severance, "he said it was the best one he had ever built; 'all the stays and braces scientifically calculated,' that's just what Risdon said. I still believe that a boiler will stand just as much—not to say a little more—pressure here as in any other country in the would. But I give way to your prejudice, Uncle Jack; give way to your prejudice and the intention of the insurance companies to get more boilers to insure. Don't you see that if one boiler is worked at 200 pounds pressure it has more capacity than two worked at 80 pounds. That's plain enough, isn't it?

"But granting, just for the sake of argument—just for the sake of argument, mind—that there is something in what you say about the strength of boilers—granting this—I'll tell you what we'll do to comfort your conscience; we'll sell our boiler to some one who doesn't know, or care anything about the advantages of high steam, and we'll buy a new one that will stand all the pressure we want to put on it. If you

are right about safe pressure on boilers, our boiler is only an old tea kettle, anyhow.

"Why," continued Severance, "200 pounds is no more than you can lift, Uncle Jack. I'm not going to let that old shell that Risdon cheated me into buying, stand in the way of saving half the coal we burn. Reading that paper just opened my eyes to what I really knew all the time. Don't you see, Uncle Jack, that the new boiler will yield me an income and make things easy for you, as I have explained?"

"Mr. Severance," said Uncle Jack, "what does that paper say about the engine and boiler that got down to 1¼ pounds of coal?"

"Nothing of any consequence," said Severance, "just a lot of rubbish to cover up the general fact. You know these writers always try to cover up the important things with something of no importance; part of their trade; I looked right for the important thing, and it was 200 pounds pressure. But here, read for yourself."

Uncle Jack read. "Why, Mr. Severance," said he, "that engine was a triple expansion condensing engine of 2,500 horse-power; ours is a simple non-condensing engine of 150 horse power."

"I've given way to you, temporarily, on the boiler question," said Severance, "but I can't stand it any longer; 150 horse-power is in the neighborhood of one-sixteenth as much as 2,500 horse-power, and will require in the neighborhood of one-sixteenth as much coal. That's arithmetic, and you can't dispute arithmetic.

"I've, for the moment—just for the moment—forgotten the difference between a condensing and a non-condensing engine. If you were going to convert our engine into a condensing engine what would you do?"

Uncle Jack allowed he would add a condenser and air pump.

"Exactly," said Severance, "that's what we'll do; we'll put in the condenser and air pump, and that will settle the whole matter. I heard you tell Sauerson's engineer the other day, that you worked our engine at four expansions, and that beats three expansions by just about 25 per cent. According to your own reckoning, we can beat that English engine easily, with a good deal to spare."

Uncle Jack felt called upon to explain the difference between a triple expansion engine and three expansions in a single cylinder.

"Just what I wanted to bring you to," said Severance, "you are now in the last corner, and the fence put up; solid facts all around you.

"Suppose now, Uncle Jack, you were to start in to make that engine, just as it stands, into a triple expansion engine; how would you go to work to do it?"

Uncle Jack said that if ever such a misfortune were to befall him he supposed he should contrive to get three cylinders, one right behind the other.

"Just what I've thought of," said Severance; "we'll put two more cylinders right on—that will make three—then we are all right."

Uncle Jack waited for his turn again, then he said: "You want to increase the pressure and strain on that old engine bed. Put your hand here. You put 200 pounds pressure and 14 or 15 expansions on that bed and you'll have a good many more pieces and less bed. Don't you feel it tremble now?

"Do you remember how much you paid for water last year?"

Severance didn't remember, but knew it was a mighty big bill.

"Well," said Uncle Jack, "if you make your engine condensing it will be about 20 times as big. Every mill in Backaway but yours is located so that pipes can be laid to the river for water supply. You can't do this, and you can't bore for water without going through about 200 feet of solid rock.

"A condensing engine where you are located is a positive luxury You cannot bring it under the head of something you need for economy. After you have paid for the water you will use you will find that economy lingers with pushing your exhaust right into the atmosphere.

"Any such change as you contemplate, Mr. Severance, requires a re arrangement of the motive plant, and you had better sit down and count the cost of the change, and the cost of operating it, before you make it. If you had a 2,500 horse-power engine, like that English engine, you might make money by putting a steam pump down at the river and forcing the water up here, but with a 150 horse power engine it wouldn't pay, and it wouldn't pay to make so small an engine triple-expansion, not if you had Roaring Brook running right by the door.

"You have told me, Mr. Severance, of some of the weak points of engineers. Let me tell you of some of the weak points of proprietors. I'll take you as an example. We are feeding cold water to our boiler when a heater would save the boiler and from 12 to 15 per cent. of the fuel. But you wouldn't listen to my argument in that direction.

"Then I wanted a damper regulator, and a pressure reducer on the pipe to the drying loft, and a few other inexpensive things. I couldn't give you figures to show 50 per cent. saving, so you thought we had better get along without them. I don't know any way to get your coal consumption down to a 1¼ pound basis, but I do know ways to cut it down. I've told you of ways to cut it down 25 per cent. All the things I have recommended are just about as common as oil cans, and the figuring on them has all been done. You can get them of the manufacturer or you can get them of the supply dealer. They sell on the market just as jackknives sell, but I have only run against a forty-mile breeze in talking to you about them. I'm all through talking; going to take things as they come."

"Uncle Jack," said Severance, "it's an old habit of yours to oppose my schemes for bettering things. I shall give up my plans for the present—just for the present—because you don't seem willing to co operate."

Then, musingly: "I shall be pretty busy for the next few weeks—expect a big order to-morrow—and if you think that heater and the other things you mention are needed, why, go right on and order them and put them in; then when I get more time we will look over my other plan again. Might as well get the benefit of the things you speak of while we are working off this order."

Very truly,

JOEL OLDONE.

An Unique Water-wheel Governor.

Several years ago I undertook to produce a governor that would regulate the motion on an overshot water-wheel. I had received some light on this subject from a neighbor. After trying two or three differing plans, and bursting as many large grindstones, and barely escaping with his life, he finally put in a balanced gate at his water-wheel and connected it with a huge fly-ball governor direct, something after the fashion of connecting the old style engine governor to a butterfly valve. This governor was made by a blacksmith; it was a marvel of simplicity, and, as we often say, "worked like a charm." The step for this governor rested on the floor, and the top bearing was attached to the ceiling above. The arms had fifty pound balls attached at their extremities, and when at their maximum speed took in a circuit of about 10 feet in diameter. It was a formidable looking piece of machinery, and admonished all who had business near it to keep at a safe distance.

I had no room for such a contrivance so undertook to construct one having "meets and bounds" to its dimensions.

It will be seen by the cut of my governor appended that the upper part of an ordinary ball governor was used, and a base piece *A* was attached, having a provision for a shaft at *B*, and another as shown at *C*. On this last upright shaft a worm *F* was fixed which engaged in the wheel *D*. The shaft *E* extended to the water-wheel gate, where a rack and pinion opened and closed it.

The mechanism for imparting a forward and backward motion to the worm *F* could be made simple enough by using the ordinary bevel wheels and clutch, but this would give too great a movement to the gate in a given time, especially when the change in the speed of the water-wheel was but slight, for when once engaged, such a clutch would remain in action until the governor reached its mean velocity and disengaged the clutch, thus alternately producing "a feast or a famine" of water.

To overcome this objection the bevel wheels *o o'* were made to revolve on studs, the axes of which were placed on an angle of about ten degrees from a vertical line. The intermediate clutch *H* was feathered to the shaft *c* and derived its vertical motion from the governor stem *P*.

It will readily be seen that by this device, a variable rotary motion of the shaft *c* was secured, varying from one eighth of a turn up to a full revolution, depending on the amount of movement given to the clutch *H*.

In other words, when a slight variation of speed took place, a correspondingly small amount of water was supplied, or shut off, as the case might require, but if the demand for more or less water was great, the clutch engaged with the driving gear to its full depth, and complete rotations of the shaft *c*

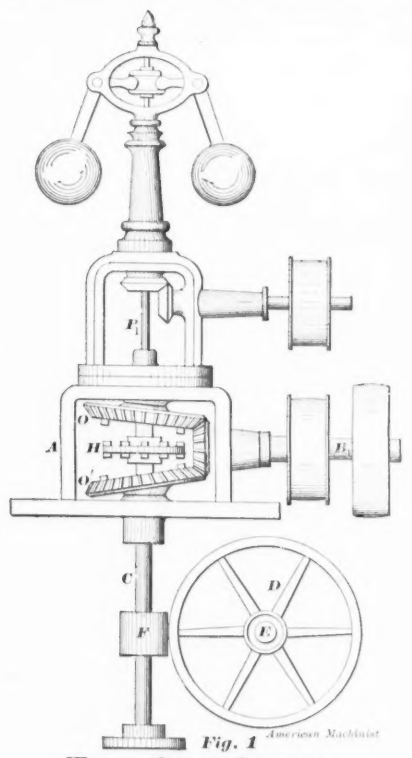


Fig. 1 American Machinist

WATER WHEEL GOVERNOR.

would continue until the desired effect was reached.

Another desirable feature connected with this intermittent motion lay in its allowing the governor perfect freedom of action during the intervals when the clutch was not in contact with the driving lugs on the bevel wheels, so that there was nothing to restrain the governor balls from assuming the true position due to their velocity.

There are now some very ingenious devices connected with water-wheel governors. Some of these go so far toward exercising intelligence in their action, that they anticipate the changes that are about to take place in the motion of the machinery, but considering the points gained by the device I show, I have seen nothing more simple.

"QUIRK."

If Andrew Carnegie carries out the ideas expressed by him at the dinner to Mr. Richards—of which we gave an account in our issue of November 15th—the days of the steel rail pool are numbered. He said substantially, that he believed such combinations always did more harm than good in the end. It is natural to reflect, however, that it is probably much easier for Mr. Carnegie to say this now after he has "made his pile" by means of such combinations, and at a time when they are especially unpopular, and are becoming daily more so as public sentiment becomes roused regarding them.

LETTERS FROM PRACTICAL MEN.

Formula for Unstayed Plates.

Editor American Machinist:

There is not much use of continuing the discussion with Mr. Guy, on the subject of the accuracy of his formula for unstayed plates, since it does not seem probable that either one of us will convince the other. I am content to let the argument close with his admission that in his formula he has not taken into consideration "the perimetral forces engendered along any circumference by the varying bending moment." The matter may now be submitted to a jury of your readers. It may interest Mr. Guy, however, to learn that my side of the argument is commended by no less an authority than Prof. De Volson Wood, one of the leading American authors on the subject of strength of materials. He writes me as follows: "I see you have attacked Guy not only ingeniously, but apparently effectually. We may say with confidence that the best formula for strength of disk encased at rim is only approximate, for no hypothesis will conform exactly to the conditions of the actual case. Grashof's applies only within elastic limits, and in that case he assumes that the plate is an amorphous body."

WM. KENT.

Milling Machine Feeds.

Editor American Machinist:

In regard to the question of direction of feed on milling machines, so much (not too much) discussed of late, allow me to suggest that for the benefit of the readers, you or some one of your older correspondents sum up the question, by noting, what seems to me the fact, that the direction to feed depends on the conditions present (supposing, of course, that the machine may be fed either way) and that in a shop doing a variety of work, it might be found advantageous to change the direction of feed many times in a day for different work, or even feed opposite ways on different cuts on the same piece. GRANT SIPP.

Piecework in Machine Shops.

Editor American Machinist:

Permit me to add a few words to what has been already said on the subject of piecework in the machine shop. There seems to be a great difference of opinion among writers on this question of expediency as to the best shop methods, and the practices that obtain among manufacturers are equally confusing.

The line of work carried on by Smith is well adapted to the piecework system, but he wants nothing done in this way. Jones, who builds a different class of machinery, can ilty adapt his work to the plan, yet everything must bend to its accomplishment.

In considering this subject, it is useless to draw conclusions from what may be the immediate result of a change from day to piecework. Usually such changes are made at the request of the workman who is desirous of earning more than his regular wages. The result frequently greatly benefits him, as well as the employer, but so far as he (the workman) is concerned, the new condition of things cannot be expected to last long. The eyes of the manager have been opened. He finds that all the powers of another intelligent mind have been enlisted in improving the method of doing a single piece of work. Better tools are now on the tool board. A new double belt has taken the place of the old rotten single one on the lathe, and the man is doing double the work, and getting about twice as much pay as when working by the day. So the change has benefited all concerned, and no one can complain. But when a new bargain is to be made with this man, or some other, a cut of 40 or 50 per cent. will probably be made on this soft job, and still leave something for the expenditure of brains and energy that have been put into it. So, step by step, a system of piecework is inaugurated which increases the output of the concern and benefits the employes, not only in affording them better wages, but by putting a premium

on skill and breaking up the too common practice of paying uniform wages without reference to ability.

I do not think that there should be any objection raised to the system on account of its tendency to lower the standard of work done. If such should be the result, the cause is traceable, I think, to mismanagement on the part of foremen or inspectors. The amount of labor thus entailed on the shop management will, of course, depend largely on the character of the work done, and the necessity for more or less precision to make the parts of machines interchangeable.

Liberality on the part of the employer in adjusting prices on both piece and contract work will do much to keep up a high standard, as well as lessen cost in the assembling departments; besides, it is to his interest to maintain the system and make it popular, at least in his own works, for by it, a greatly increased product may be had, without a corresponding additional cost.

"QUIRK."

Lathe Tools.

Editor American Machinist:

It would be altogether useless to attempt to lay down a set of rules for shaping lathe tools that would meet with general favor. Every machinist, it seems, has his own notions on this subject; besides, I have that one yet to find who can grind a turning tool and set it so as to cut the same shaped shaving it did before grinding, or to leave the finished surface with the same appearance that a tool of apparently the same shape had left.

I append some cuts showing a set of lathe tools as I have been in the habit of forming them; they may interest some of your readers, and, perhaps, lead to some valuable suggestions on this subject.

Judging from my own observation, the tool No. 1 is not now used as much as in former times. I think this results from the facility that emery wheels afford for cutting down steel to any desired shape, so that tools something like No. 3 have taken the place of No. 1. If the cost of keeping up emery wheels was closely run down, I think it would be found that much would be saved by dressing roughing tools like No. 1. It is well-known that no part of an emery wheel suffers so much as the corners, and tool No. 3 is particularly hard on this part of the wheel. The regrinding of such a tool reduces it to the form shown by 3′, which illustrates the destructive grinding required to keep such a tool in cutting order. Besides, it is often very desirable to find an emery wheel having square corners.

I may say here that I much prefer a grindstone to a dry emery wheel, for the reason that the wheel is so liable to take the temper out of tools, especially those with sharp points as a threading or side tool. Then frequent heating and tempering not only takes time, but is liable to injure the steel.

Tool No. 2 I have found to work admirably on small shafts that required turning some distance from the end. Take, for instance, a shaft 1 inch diameter and two or three feet long, to be turned 12 inches at the ends. The merit possessed by this tool for such work lays in the position of the cutting edge with relation to the center of the shaft. This is shown at *A* by dotted lines representing a shaft. It is noticeable that the tendency of the shaft to spring up is not so great here as it would be if a tool like No. 1 is used.

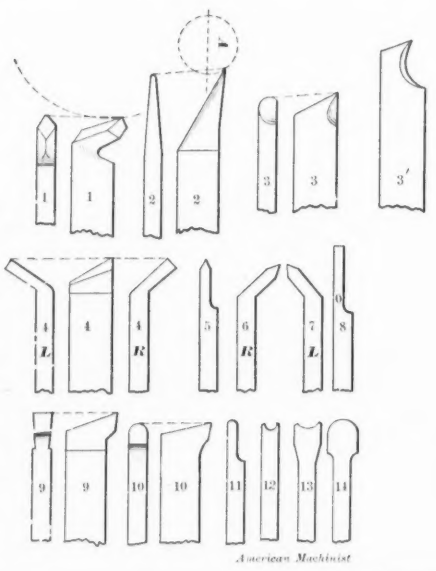
The form of cutting-off tool shown at No. 4, while indispensable on certain kinds of work, has the bad habit of springing and "gouging," especially when the tool post is not very rigid. When tool No. 8 can be used it is always preferable, but even this, to work well, requires great care to see that it has clearance on all sides. As its strength is often put to the test, I have found the least amount of clearance on the sides, so that it is perceptible, is the best, and to be slightly concaved is better than straight.

The point should be at least .01 inch wider than at 0. Tool 4 should have same taper, but as it is more difficult to set these tools so as to divide the clearance on the sides, the lower edge should be at least one-sixteenth inch thinner than the upper edge.

Of the special shapes from No. 10 to 16 nothing need be said. Many other forms are often required, but those shown will cover a great variety of work. All I can say about the side tool No. 15 is that it is one of the most useful on the tool board, and to find it in good order, and shaped so as to reach the center of a shaft, is a pretty sure sign of a good workman.

The boring and threading tools 17, 18 and 19 must, of course, be of suitable lengths, and otherwise proportioned to the work required of them. No. 17 should be ground to cut both ways, for such tools always cut better coming out than going in—a suggestive feature in metal-working which doubtless has led to many improvements.

I have often been surprised while passing through machine shops to find so few lathe men using oil stones. No tool-board should be without one; a slip is usually all that is needed. There can be no doubt but that any tool will hold its edge much longer, and do better work when properly whetted than when set to work with a rough wire edge, such as the emery wheel, or grindstone, is sure to make. It, of course, requires some care and skill to use the oil stone properly, else the cutting qualities of the tool may be injured. It is best to place the tool to be whetted on some solid support; then the



LATHE TOOLS.

stone may be held firmly against the surface, so as not to round an edge that should be keen and sharp. The effect of whetting is the most striking when we compare a water-cut finish thus made, with that of one made by a tool not whetted.

There are other lathe appliances which I know are not in general use, and may be unknown to some.

Before centering machines were used, a method of centering shafts, as well as shorter pieces of round iron, was employed which I have not seen improved upon. The piece to be centered was placed in a lathe on approximate centers made with a center punch. A dog was attached at the driving end, and in place of the regular dead center one was supplied having the same taper, but flattened on four or five sides, same as a hand reamer. With the shaft thus placed a tool of the form shown by No. 20 was attached to the tool post, as shown in Fig. 21. The lathe was started, and by means of the cross feed, the forked tool was gently brought to bear against the shaft at a point where most desirable to be made true. While the pressure of this tool was increased the reaming center was forced gently forward, and, generally, before the center in the shaft had reached a proper size, it would be found to be perfectly central, and the shaft touching the fork on all sides alike.

This plan is more expeditious than that of centering in a steady rest, and has the merit also of making a more perfect center than can be made with a turning tool, when the revolutions of the shaft are affected by irregular shaped iron. The same might be said of the forked tool, but I should have said that as soon as the reamer has reached the center of the shaft the fork is withdrawn, and the reamer is allowed to perfect the center, which it does with a few turns of the shaft. With a small drill, or slender punch, the work of centering is completed in the usual way.

The above method of centering is slightly modified by some in dispensing with the upper arm of the fork on tool 20, thus forming an angular knee which requires no vertical adjustment, but when the fork is properly set in position it will do its work quicker than the knee, which has but one point of contact with the shaft.

I have used two other forms of centering reamers as shown by cuts 22 and 23, but find the square or pentagon form renders better service, because the point is not so liable to crumble.

"QUIRK"

Voting Machines.

Editor American Machinist:

In your issue of September 20th, W. J. asks about a patented voting machine, and you advise him that a patent solicitor can procure a copy for him.

There are many patents on voting machines, and they are "N. G.," because there is no demand for them. It is possibly the one thing most ardently not wanted by legislative assemblies, where inventors of such things expect to be received with open arms.

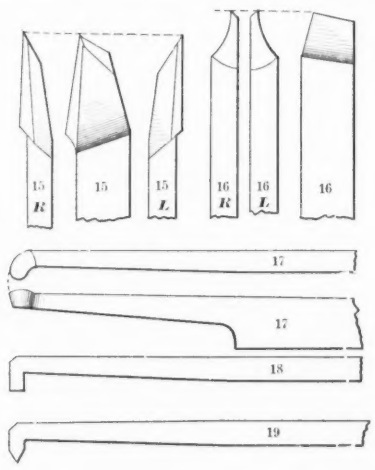
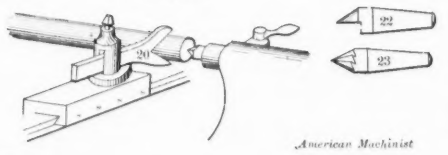
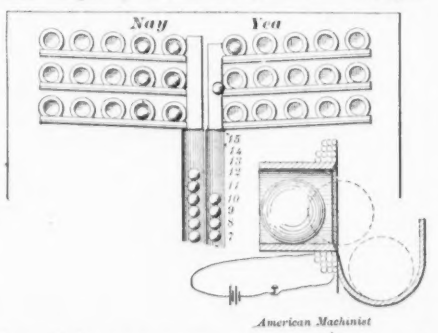


Fig. 21



The necessity of dilatory measures to prevent the passage of objectionable legislation is too strong to permit the minority ever to favor a machine which would deprive them of their most effective weapon. The majority would welcome such weapon



for their own use were they not ever conscious that the wheel of fortune will surely relegate them to the minority side sooner or later, and as likely sooner as later. If such a thing could be appropriated by either party as its personal property, to be used or unused, according as it might be advantageous to that party, the inventor would find quite a bonanza, but that is clearly impossible, and hence, no voting machine in ours, if you please.

Probably the most ingenious and effective of all these machines is one invented by a man named Blackie, some years ago. The patent has now expired. He was an electrician, and his apparatus was electrical.

The machine consisted of a vertical table pierced with two series of shallow cells. Each series contained a cell for each person entitled to vote. One series for yea, the other series for nay. The cells were arranged in rows inclining slightly upward from the center toward the margin. Each cell consisted of a tube of soft iron half an inch in diameter and half an inch in depth; around the open end of each is a coil of insulated wire, one end of which is grounded, and the other connected to a battery of some sort, with a circuit closing button located on the desk of a voter. Thus each voter has upon his desk two circuit closers, one connected with a yea cell, the other connected with a nay cell.

In each cell is placed a light hollow iron ball large enough to nearly fill the cell. Upon closing circuit the iron tube is magnetized, and the ball instantly brought to the mouth of the cell by magnetic attraction, whence it immediately falls into a trough when the circuit is opened again by releasing the circuit closer.

The ball rolls down the trough to a central tube of glass into which it falls.

The glass yea and nay tubes are close together, and as the yea and nay balls successively fall into their tubes, their relative members are visible to the eye at every moment. Every voter knows instantly whether his vote has been correctly recorded.

Thus the vote is taken and recorded as rapidly as the roll can be called, or without any roll call, for that matter, because even though all the voters press their buttons at the same instant, the balls will arrange themselves, and the result will be visible in a few seconds.

That is exactly the result which is not wanted by the party which resorts to yea and nay voting as a means of delay. A few smart parliamentary tacticians can in a few minutes pile up motions, and yea and nay calls enough to occupy several hours.

This is the weapon of the minority, and though it is some times misused, it is an element of safety against insanity of the majority, and it is a weapon which neither side is willing to abolish, while the "previous question" remains among the rules.

R. D. O. SMITH.

Some Advice from a Business Man.

Editor American Machinist:

In my business of selling tools and supplies, I frequently run across a good mechanic who starts a jobbing shop "on his own hook."

He has saved enough money to barely buy his little outfit, and then begins soliciting business.

His *mechanical training* has been good, but his knowledge of business ways is very limited, and as a rule, he takes in everything that comes his way, in the way of work, regardless of who it is for, or when he is to be paid for it.

The first thing he knows, he has a lot of uncollectible accounts on his "slate," and a lot of work on hand, finished but "to be called for later."

The supply dealer wishes him well, and is doing what *he* can to see a good, honest chap get a start, but the first thing *he* knows, his machinist friend is in debt to him for tools and materials, used on the uncalled and unpaid for jobs.

If our friend would adopt the rule of exacting from all such customers, a deposit of sufficient to make him secure, he would be better off in the long run, although such a course might, in a few cases, drive a customer away. I am confident that many a supply dealer and machinist who reads this article, will say at once, "we have been there."

W. B. PATTERSON.

Some Mysterious Disappearances—Not All of Compressed Air.

Editor American Machinist:

I took great pleasure in listening, on November 16th, to the very able and comprehensive paper read before the New York Railroad Club, by Mr. R. A. Parks, M. E., and entitled "Economy in Compressed Air

Transmission for Commercial Purposes and for Air Brake Purposes." As the paper will, of course, soon be published, and will be accessible to those interested, I will not attempt to give any account of it as a whole, but I would like to speak of a few of the many points presented that seemed to especially impress me.

Of the transmission of compressed air the paper had little to say, as there is, indeed, little that need be said, and it was chiefly, and very properly, occupied with a consideration of the economical compression of air, and of its economical application. The well-known power losses in air compression, through the heating of the air and in its cooling again before use, were spoken of, and a large portion of the paper was then given to a consideration of the different styles of air compressors and of their relative economy. The efficiency of the water jacket was placed decidedly lower than my experience and observation put it, and in this connection (if the bull may be permitted) I suddenly encountered the apparition again of the mysterious disappearance that I have lately been having so much trouble with. Very little cooling of the air during compression, it was asserted, is ever accomplished by the water jacket, and if indicator cards repeatedly and continually and invariably show a compression line closely approaching the mean between the isothermal and the adiabatic, the cards are not to be read as their faces indicate. The low compression line is to be credited not to the cooling of the air by the water jacket, but to the mysterious disappearance of the air, or, in other words, to leaky pistons.

Here is indicated a new and successful industry that has arisen. While we are improving our machinery and refining our methods to effect the interchangeability of parts, or the absolute sameness of one with another, it should encourage us in our hopes of complete success when we see how much has been accomplished in the production of leaky pistons for water jacketed air compressors. If the indicator cards from the thoroughly water jacketed air cylinders do not indicate that the water jacket accomplishes a considerable cooling of the air every time then they indicate that the pistons leak an enormous quantity of air, and that all the pistons leak with a miraculous uniformity. Proof is ready at hand, for those who want to see it, that the pistons do not leak. Those who do not want to see it, of course, will not see it.

The paper spoke of the jet and spray compressors, and then of the two stage compressor, in which the air is first partially compressed in one cylinder, then passed through an intercooler, and the compression completed in a second cylinder. That some saving of power is accomplished by the cooling of the air, and its reduction in volume, before entering the second cylinder, must be conceded; but the saving is not accomplished for nothing, and it may well be questioned whether, for common working pressures, say, 60 to 70 pounds gauge, it does not cost more than it comes to. The most effective feature of water jacketing, the jacketing of the cylinder heads, is abandoned, the friction and complication of the machine, by the use of two cylinders instead of one, is increased, the friction of the air through traversing tortuous passages and double sets of valves is also increased. The diagram, Fig. 1, presented with the paper, is an ideal one, and does not represent any case of actual compression in a two stage compressor. The air does not enter and fill the second cylinder entirely cooled to normal temperature, and cannot possibly do so, as I showed in an article in the AMERICAN MACHINIST, February 1, 1893. How much cooling of the air is effected by the device of the intercooler between the cylinders has never been given to the public. And here I come across another case of "mysterious disappearance," and with it a fine opportunity to introduce another of my bulls. The disappearance in this case is the disappearance of something that has never appeared. I never saw, I have never seen, any one who ever saw, a set of authentic cards from a two-stage compressor, with intercooler, mechanically moved valves, and "all the modern improvements." It is understood that such cards, if exhibited, would show not only,

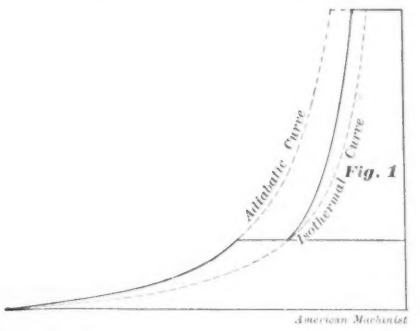


Fig. 1

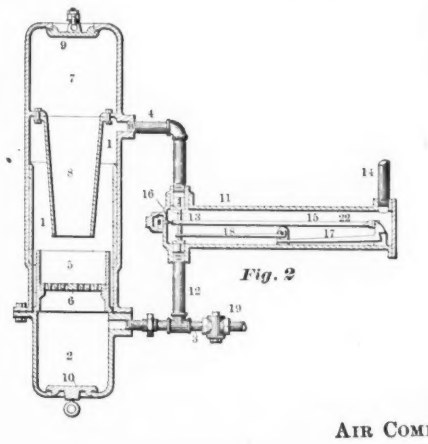


Fig. 2

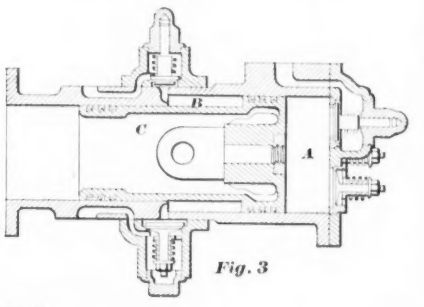


Fig. 3

AIR COMPRESSION.

what I assert, that the air is not at normal temperature as it fills the second cylinder at the beginning of the final compression, but also that the mechanically moved valves, if adjusted for a certain speed and pressure, would not be all that could be desired if either the speed or the pressure were changed.

The paper, after its discussion of the compressors, proceeded to speak of the economy of reheating the air before use, and the very promising looking design, Fig. 2, for an automatic compressed air heater was presented. This heater consists principally of the self-feeding coal-burning stove at the left, the shell of the stove being air-tight and strong enough to stand the air pressure. The horizontal chamber at the right is the temperature-regulating apparatus. The compressed air enters by the pipe 3 and passes horizontally into the stove under the grate, and passes out of the stove by pipe 4, carrying the products of combustion, and down by the valve 13 into the horizontal chamber, then out through pipe 14 directly to the motor or engine where it is to do its work. The brass rod 15 is expanded by the heat of the air and operates, through the levers 17 and 18, the valves 13. Should the air become too hot the upper valve is closed, and the lower valve is opened, and the air enters the horizontal chamber without passing through the stove. When the air is in steady flow and the stove in full operation the valves will probably each be partially open, and only a portion of the air will pass through the stove, the resulting temperature of the air when finally reunited being the temperature desired.

The latter part of Mr. Parks' paper was devoted to the air-brake pump. More than 30,000 of these pumps are said to be in use, a number greater, perhaps, than that of all other air compressors combined. The wastefulness of the air-brake pump in its application of steam to the work of compression was fully conceded, and yet its persistent use for air-brake service was completely vindicated. The pump is very simple, which is an important point, and the steam used to operate it is mostly steam that otherwise would be blown off by the pop safety valve. The pump on the locomotive is usually worked when stops are made at stations or when running down grade, and if the pump used less steam it would generally mean not that so much steam was saved, but that the pop valve would have so much more to do. An interesting account was given of different styles of pumps, mostly two-stage duplex or compound that were devised to secure a better steam economy, but all abandoned for the single cylinder pumps. Fig. 3 is a sketch given of a single piston, two-stage, belt-driven compressor. The air is first compressed in chamber *A*, and the second compression is done in chamber *B*.

The following table was shown upon the blackboard and is understood to be a part of the paper presented:

PUMP.	Vol. free air compressed to 90 lbs.	
	Per min.	Per lb. of steam at 140 lbs.
	Cubic feet.	Cubic feet.
8-inch.	26.3	1.85
9½-inch	44.9	2.49
Compound	43.3	4.89
5 inch duplex ...	29.4	2.06
7 inch duplex....	38.7	2.43
Single compressor	.....	8.80
Two-stage compressor.....	.....	13.70

The first five of the "pumps" in the table are air-brake pumps, while the last two are "air compressors," properly and commonly so called. The table was chiefly of interest to me as exhibiting another case of "mysterious disappearance." The mysterious disappearance in this case is in the efficiency of the compressors, especially of the two stage compressor, which the whole paper seemed to be especially designed to glorify. It will be noted that, according to the table, the two-stage compressor will compress 13.70 cubic feet of free air to 90 pounds for one pound of steam at 140 pounds. Single air cylinder, water jacketed compressors can be furnished that will do 40 per cent. better than this.

FRANK RICHARDS.

Cheap Labor.

Editor American Machinist:

The "low estate" in which the mechanic is supposed to have a being, by those who presume themselves to be something more, was possibly never better exemplified than in what Gen. Lew Wallace has recently given to the press. General Wallace was, no doubt, up to the standard of a good many other generals in the Union Army, but when he touches industrial problems he flounders—just absolutely flounders.

The General, for whom all have profound respect, concludes that because the Japanese have the best of the Chinese in the pending international dispute that the last-mentioned nation is to become great in manufacture, and, so to speak, trouble Western nations beyond endurance.

Five cents a day is what, he says, Chinese women will work for in factories, while ten cents will satisfy men.

Possibly it never occurred to General Wallace that in all manufacturing countries that have come to the front, the man who was competent to earn four dollars per day was worth, to the employer, as much as three men who could earn two dollars a day.

It takes not years but generations to build up great manufacturing countries. The Chinese are not gifted with the talent that belongs to manufacture. They are imitators, and nothing more, so far as manufacturing is concerned, but imitation falls very far short of success so far as manufacture is concerned. Changes come from day to day, and these changes must be met.

Some years since I was interested in the construction of considerable machinery that went to China. The engineer in charge of erection assured me that no Chinese mechanic would drive more than 100 nails per day. He must first bore for the nail, then drive it, and he could not be crowded beyond the limit of one hundred. He stuck at that.

Put this at what an American mechanic would do, and what part does ten cents a day in the way of wages play?

General Wallace is a far seeing man in his way, but it is evident that when it comes down to mechanical operations he is "just a little off." FRANK GLEASON.

Pattern for an Elbow.

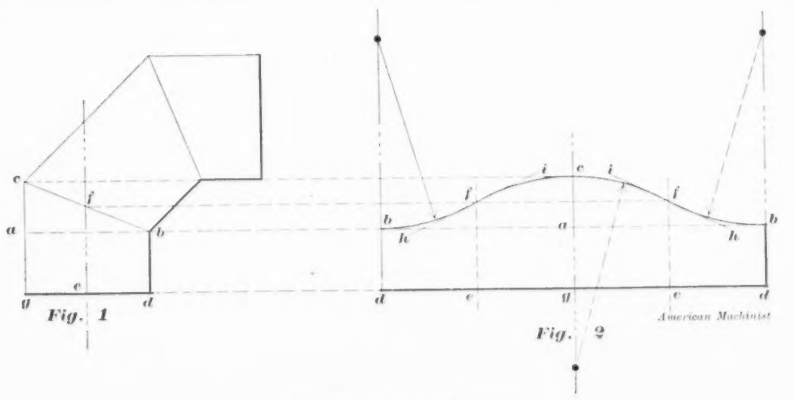
BY GEO. GUNTZ.

In your issue of September 20, 1894, I gave a rule for laying out a pattern for a square or right angle elbow in two pieces. I now wish to supplement it by showing how a pattern for an elbow of any angle and any number of pieces may be laid out by the same method.

In the former article I explained the case where a drawing of the elbow was not a necessity, but in this case it will be necessary to make a side elevation of the elbow, in order to determine the width of the pieces at the back and throat, so that the angle between the planes of intersections can be determined.

The side elevation, Fig. 1, also shows the angle *a*, *b*, *c*, made by the planes *a b* and *c b*.

Having made the elevations, lay out the circumference, Fig. 2, and divide it into four equal parts; then set off the throat *d b*, Fig. 1, on *d b*, Fig. 2, *e f*, Fig. 1, on *e f*, Fig. 2, *g c*, Fig. 1, on *g c*, Fig. 2. Then with the bevel set to the angle *a*, *b*, *c*, Fig. 1, draw the lines *h i* on Fig. 2, through the point *f*, making the same angle with the horizontal dotted line *a*; then by trial find a radius which will cut the point *c*, and describe an arc tangent to the lines *h i*. Use the same radius to describe the throat curves, as shown, add laps where needed, and the pattern is complete.



PATTERN FOR AN ELBOW.

Mr. John Platt, Assoc. M. Inst. C. E., has opened an office at 136 Liberty street, New York, where he will devote especial attention to hydraulic machine tools, such as were introduced in England by Fielding & Platt and R. H. Tweddell. Mr. Platt, in connection with his father, James Platt (who will remain in England), will also undertake the introduction of American inventions in England.

There has recently been deposited in the Patent Office Museum at Washington a *fac simile* copy of what is believed to be the first patent for an invention issued in America. The subject of the patent was a water-wheel, and it was granted to Joseph Jenkes by the General Court in Boston, March 6th, 1646.

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CONTENTS.

	PAGE.
Eighteen-Inch Shaper	1
Electric Lighting by Wind-mill Power. By Bell Crank	1, 2
Spacing Holes. By Easy Way	2
Plates of Uniform Strength. By Albert E. Guy	2, 3
Making Pin Machines. By George Guntz	3, 4
Universal Drawing Table	4
Doings at Backaway. By Joel Oldone	4, 5
An Unique Water-wheel Governor. By "Quirk."	5
Letters from Practical Men: Formula for Unstayed Plates. By Wm. Kent... Milling Machine Feeds. By Grant Sipp....Piecework in Machine Shops. By "Quirk."....Lathe Tools. By "Quirk."....Voting Machines. By R. D. O. Smith . Some Advice from a Businessman. By W. B. Patterson..Some Mysterious Disappearances—Not all of Compressed Air. By Frank Richards. ...Cheap Labor. By Frank Gleason.	5, 6, 7
Pattern for an Elbow. By Geo. Guntz	7
Triple-screw Cruisers	8
Power for Nothing	8
Machinists' "House Organs."	8
Literary Notes	8
Questions and Answers	8, 9
Report of Committee on Comparison of Round and Square Test Bars	9, 10
Fifteenth Annual Meeting of the A. S. M. E.	10
The Picture of Geo. H. Corliss	10
Two Mechanics Return	10
Steam Engine Fly-wheels. By Wm. R. Kales.	10, 11
Brush Arrangement for Milling Cutters. By "Quirk."	11
Why Does a Bicycle Stand Up? By J. Begtrup.	11
Manufactures	12, 13
Machinists' Supplies and Iron	13

Triple-screw Cruisers.

Admiral Meade's paper, read before the recent meeting of naval engineers in New York, has at least provoked a great deal of discussion if it has had no other effect, and there are those who propose that one of the new triple screw naval vessels shall run a race with the "Lucania" or "Campania" to decide whether or not the fastest naval vessels can overhaul the fastest merchant vessels.

It is declared by some naval officers that such a race is not at all likely to be allowed because it would be considered undignified, but however much lacking in dignity such a race might be, it would certainly be interesting and might also prove of value to naval engineers and constructors.

Admiral Meade's observations on the triple-screw feature, to the effect that it is not a success, seemed to lack support, especially after Chief Engineer Melville's reply, in which he gave facts and figures to sustain the triple-screw principle, the introduction of which into our navy he himself is mainly responsible for.

It is undoubtedly true, as Commodore Melville intimated, that the principle, or rather its application to such vessels as the "Columbia" and "Minneapolis," is yet an experiment, still the plan certainly has undeniable advantages, amongst which may be mentioned the lessened risk of total disablement of propelling machinery, lessened height of engines, deeper immersion of screws and greater economy in cruising at various speeds resulting from the ability to steam at three different rates, while yet driving the engines in actual use at such a rate as to get an economical performance from them. While there may be objections to the system that far outweigh these advantages, Admiral Meade mentioned only one objection—expense, and if that is the only objection, and if there is a disposition to curtail expense in the navy we could, we think, mention a number of ways of doing it that would be preferable to blocking the way of development in the engineer department.

Respecting this same triple-screw arrangement, a curious instance of the "unexpected which sometimes happens" was referred to in Commodore Melville's paper.

It was expected when designing these vessels for three screws that, the center screw being aft of the others, it would work in water having a considerable backward motion, given to it by the other screws, and that its pitch should, therefore, be greater, in order that its number of revolutions should be the same, all the engines being similar.

Nothing could be more natural than to reason thus and to so design things, and yet before the first of the vessels was completed it became known that what had been expected to happen would not happen, and the second one of the two triple-screw vessels, the "Minneapolis," has a screw with 6 inches less pitch than that of the two side screws, turns one revolution per minute faster with three pounds higher effective pressure, and utilizes 700 more horse-power.

Power for Nothing.

We publish elsewhere in this issue an article which treats of the subject of obtaining electric light from power developed by wind-mills. It is, we think, interesting and instructive, especially to those who may be said in a sense to make a specialty of free power. Amongst these may be mentioned those well meaning persons who, whenever they see tides flowing, water falling, waves beating, or objects blown about by the winds, immediately fall to thinking of the vast amount of power thus going to waste. So far their thinking is all right probably, but they do not usually stop here; they go on and conceive ideas for "harnessing these tremendous forces of nature, and placing them at the service of mankind," for which harnessing operation they, of course, expect to reap rich rewards

The trouble with most of these people is that they know next to nothing of the means which must be employed to transform potential energy into useful work, and that in most cases the transformation will cost more than to obtain an equivalent amount of power by the regularly practiced methods.

The "utilization of the power of tides" is a favorite scheme of those who hope to obtain power for nothing, and there may be places and circumstances where this may be done, but when we consider that power so derived would be comparable to an engine making only two strokes in 24 hours, and working at a pressure of 4 to 20 pounds per square inch, we at once see that vast quantities of water must be handled before the amount of power obtainable in this way will amount to anything. To get 100 horse-power from an engine making two strokes (one revolution) per day at 2½ pounds mean effective pressure would require a cylinder of tremendous proportions, and to get the same power from the fall of the tides, over five and a half million gallons of water would have to be handled at each ebb tide if the mean fall were five feet, and only in very exceptional cases, if ever, would the cost of construction and maintenance of the necessary reservoirs, etc., fall below the cost of obtaining power by the present methods.

Machinists' "House Organs."

It is announced that another of the "house organs," *i. e.*, a regular publication issued by a manufacturing concern, is to be discontinued; and this leads us to remark (at the risk of seeming to talk shop) that advertising by means of such publications has been repeatedly proven to be the most expensive possible way for machinery makers to advertise.

It is quite natural, perhaps, for a manufacturing concern which does a large business, and whose advertising bills are large, to conclude that by publishing a small sheet of its own, and attempting to make it more or less interesting in a general way, it can insert its own advertisements on a liberal scale, and by scattering these sheets broadcast among those who are buyers, do its own advertising at the mere cost of printing and postage. It seems all very simple and easy, but nevertheless experience shows that it is a mistake. People will not read nor preserve such publications; they never acquire any standing whatever; are never quoted nor referred to as authorities on the subjects of which they treat, and are far more expensive than they are expected to be.

Lots of money is thrown away by machinery manufacturers in advertising, by the selection of "cheap mediums" and by general inattention, but there seems to be no more effective way of getting rid of money without return than by starting an organ and publishing one's own advertisements.

According to a recent decision of the U. S. Supreme Court, an inventor or patentee whose invention may be used by the U. S. Government without agreement or contract, has no claim against the government, the court holding that "some element of contractual liability must lie at the foundation of every action," *i. e.*, against the government.

The amount at issue in this case was about $60,000, claimed as compensation for the use by a government architect at the Capitol grounds of a patented pavement. The decision may and probably will influence the action of inventors of arms and other patentable devices which must be submitted to government officials, because virtually it seems to give such officials the power to simply adopt and use anything they may see fit without compensation to the inventor, even though he have a patent issued by the government itself giving him the sole right to manufacture or sell within the United States.

As a result of the effective competition of the cable lines in New York City, it is said that the receipts of the Manhattan Elevated Railroads have fallen off during the past fiscal year to the extent of about $1 000,000, and as one of the effects of this, and possibly also of the near approach of genuine rapid transit by underground railroads, the Manhattan Company is now doing a few of the things which it should have done years ago, and which, if done then, might have prevented the competition which they now seem to so much fear. The recently introduced improvements are not much, it is true, but still are sufficient to indicate what competition can do in such cases, and it is not unlikely that they will be followed by still other improvements, such, for instance, as continuous trains around the city instead of the senseless stoppage, switching, and reversal of trains at the Battery, as now managed.

Literary Notes.

ELEMENTS OF MECHANICAL DRAWING, USE OF INSTRUMENTS, GEOMETRICAL PROBLEMS AND PROJECTION. By Gardner C. Anthony, A. M. Professor of Drawing in Tufts College; Dean of the Bromfield-Pearson School; Member of the American Society of Mechanical Engineers.

In this work the study of mechanical drawing is commenced by a series of problems relating to the construction, in a geometrical and mechanical way, of geometrical figures, such as angles, triangles, quadrilaterals, and other polygons, circles, pyramids, etc., etc. After this conic sections are taken up; and then follows general instructions for drawing, giving the principles upon which the delineation of working drawings depend. The development of surfaces, intersection of surfaces, screw threads and bolt heads receive their share of attention; and the last part of the work treats on isometric and oblique projection. The work is well adapted for the use of beginners, and the whole arrangement is such as to make it very suitable for teaching in evening drawing schools, high and manual training schools, and college classes. It is published by D. C. Heath & Co., Boston, Mass. Price $1.50.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(541) J. A. D., New Bedford, Mass., writes: Please state the proper dip of the buckets of a steamboat wheel. *A.*—When a vessel is working always in smooth water the immersion of the top edges of the buckets of a paddle-wheel should not exceed ⅓ the depth of a bucket, and for general service at sea an immersion of ⅓ the depth of the bucket is sufficient. If the vessel is intended to carry cargo, the immersion when light need not be more than 2 or 3 inches, and should not be more than the depth of the bucket when at deepest draught. The efficiency of the wheel falls off rapidly with the immersion of the wheel.

(542) A. R. F., Montreal, Canada, writes: Please inform me of a way of making marine glue. *A.*—Take of gum shellac two parts, caoutchouc (India rubber) one part by weight. Dissolve the caoutchouc and shellac in separate vessels, in ether free from alcohol, applying a gentle heat. When thoroughly dissolved mix the two solutions, and keep in a bottle tightly stoppered. This glue resists the action of water, both hot and cold, and most of the acids and alkalies. If the glue be thinned by admixture of ether, and applied as a varnish to leather, along the seams where it is sewed together, it renders the joint or seam water-tight, and almost impossible to separate.

(543) C. W. C., Baltimore, Md., writes: Please inform me what is "throttled" and "superheated" steam. *A.*—In steam engineering the term "throttled steam" is usually understood to mean steam the pressure of which is less than that in the boiler, caused by partly closing the throttle valve.

In regard to superheated steam, it may be said that when water is heated in a vessel steam will be formed when ebullition begins, and there will always be a fixed pressure for every temperature, so long as the steam is in contact with the water. At any such stage the steam is called saturated steam. If, now, this saturated steam has an additional heat imparted to it, the steam is then called superheated steam.

(544) W. D. M., Garfield, N. J., asks: Is it safe to let an engine run without oiling the slide valve and piston? *A.*—If the engine is of the ordinary construction, with the valve and valve seat made of cast iron, it is not safe to run it without oiling the valve and piston. 2. Will steam get under the slide valve and take the place of oil? *A.*—The steam will get under the slide valve, but for satisfactory results it should carry oil with it. 3. Will a steel boiler 6 feet in diameter, 18 feet long, and shell $\frac{9}{16}$ inch thick be injured by allowing a vacuum to be formed in it? *A.*—A vacuum or partial vacuum in the boiler has a tendency to injure the boiler, and should be avoided as much as possible.

(545) C. J. C., Wilkes Barre, Pa., writes: Your answer to my question is hardly satisfactory. I do not find in your articles on "Practical Drawing" the method of turning the horizontal plane of projection around the ground line. Mr. Meyer speaks of turning the vertical plane, but in none of the numbers which I have can I see any method of turning the horizontal plane around the ground line. *A.*—We may assume that the plane of the paper is the vertical plane of projection; in this case the horizontal plane of projection is perpendicular to the plane of the paper. In order to bring horizontal projection in full view, the horizontal plane of projection is assumed to be turned around the ground line (like a door on hinges) until it coincides with the plane of paper. The only difference between turning the vertical and horizontal plane of projection is that the latter is turned towards the bottom of the board, and if we have to turn the vertical plane, which must be done when it is assumed that the horizontal plane of projection is the plane of the paper, and the vertical plane is perpendicular to it, the latter must be turned away from the lower edge of the board. The result is the same; in either case, the vertical projection will fall above the horizontal projection.

(546) F. W. P., White Oaks, N. M., writes: In your answer to Question 360, you give a reason why in gas engines a charge of gas is not exploded in each end of the cylinder, but your reply does not suit my case. I have a small engine operating a lathe and pump alternately; and when the engine works at all, it does so by spells. It will be running right along and to all appearance doing good work, when all of a sudden it will gradually die down. I work on the engine a day or two, and don't know what I have done to it, when all of a sudden off she goes again, and works for another half day or so. The gases are ignited by electricity, and the apparatus seems to work all right, even when the engine is not running. The valves are all clean and draw the gasolene all right. I have written to the manufacturers twice, but have received no reply. I thought that probably you might make some suggestions which may help me out of the trouble. I know a small steam engine would double discount this one, but I cannot get the company to buy one, so I have to get along as good as I can. *A.*—If you will read carefully the answer to Question 360, you will find that this answer was not intended to cover your case. We cannot locate the cause of your trouble without examining the engine, but we would suggest examining the exhaust pipe, which may be choked up by the products of combustion. The trouble may also be due to not having a true explosive mixture.

(547) F. C. G., Indianapolis, Ind., writes: I wish you would please name good books treating on dynamo and motor construction. I am trying to learn the business as much as possible from books, and would like to know how to compute the amount and size of wire required for any given capacity. *A.*—It is difficult to recommend suitable books to persons with whom we are not acquainted. However, "Arithmetic of Magnetism and Electricity," by John T. Morrow, M. E., and T. Reid, M. E., and published by the Bubier Publishing Co., Lynn, Mass., is an excellent book for becoming familiar with all those rules of electricity and magnetism which are directly connected with their commercial application; their use is explained by numerical examples of each. "Continuous Current Dynamos and Motors, Their Theory, Design and Testing," by F. P. Cox, and published by The W. J. Johnston Co., Ltd., 41 Park Row, New York, is another excellent book. It is possible that you will need a more elementary work before you can master the principles in this book, but, anyhow, it is a useful book to have. "Dynamo and Motor Building for Amateurs," with working drawings, by C. D. Parkhurst, published by the last-named company, may be of aid to you. "Practical Management of Dynamos and Motors," by F. B. Crocker and S. S. Wheeler, published by D. Van Nostrand Co., 23 Murray street, New York, is another good book.

(548) L. C., Chicago, Ill., writes: Kindly give me the velocities in feet per minute that good manila rope should run to transmit one horse-power. *A.*—For transmitting one horse power, the ropes should run at the following speeds:

Diam. of rope	½ inch	Speed in ft. per. min.	1,034
" " "	⅝ "	" " " "	652
" " "	¾ "	" " " "	454
" " "	⅞ "	" " " "	333
" " "	1 "	" " " "	260
" " "	1¼ "	" " " "	164
" " "	1½ "	" " " "	114
" " "	1¾ "	" " " "	83
" " "	2 inches	" " " "	73

The basis for this table is the assumption that a rope one inch diameter should have a working strain of 200 pounds at all speeds. This is about $\frac{1}{20}$ of the strength of the splice. This large margin is to enable the rope to perform a large amount of useful work before it is so weakened by wear that it is necessary to be renewed. Many engineers recommend a larger horse power for the speeds than is given in the table, but we believe that those here given are advisable except in temporary installations. For satisfactory results, the diameter of the pulleys should not be less than forty times the diameter of the rope, and as much larger as it is possible to make them. This rule applies also to the idle and tension pulleys as well as to the main driving pulley. The angle of the sides of the grooves in which the rope runs varies, with different engineers, from 45 to 60 degrees. It is very important that the sides of these grooves should be carefully polished, as the fibers of the rope rubbing on the metal as it comes from the lathe tools will gradually break fiber by fiber, and so give the rope a short life. It is also necessary to carefully avoid all blow holes, as they will cut the rope out with surprising rapidity.

(549) Z. H., Paterson, N. J., writes: I am requested to construct two air tight floats or buoys, each is to be 10 inches diameter and 21½ inches long. They are to be filled with compressed air of 50 pounds pressure per square inch. I want to know if these two buoys will safely support 225 pounds placed on top of them in still water, if not what size should they be? Will buoys of less dimensions, but containing a greater air pressure, answer? *A.*—The increase of air pressure in the buoy will not increase the buoyant effort, on the contrary, it will decrease it, because when the air pressure is increased its density or weight per cubic unit is also increased, and, therefore, will increase the depth of flotation. The weight of air is, however, so small that we shall here neglect it. The weight of water displaced by a floating body is equal to the weight of the body. We shall assume that the weight of each buoy is 40 pounds. The volume of water displaced by each buoy when it is completely immersed, is equal to the volume of a cylinder 10 inches diameter and 21½ inches long which is equal to

$$\frac{10^2 \times .7854 \times 21.5}{1,728} = .977 \text{ cubic foot.}$$

Taking the weight of water at 62.5 pounds per cubic foot, then the total weight of water displaced when the buoy is completely immersed is

$$.977 \times 62.5 = 61.0625 \text{ pounds,}$$

which is the buoyant effort on the cylinder. The weight of the buoy we have assumed to be 40 pounds; hence the buoyant effort for supporting the weight on top of the cylinder is 61.0625 − 40 = 21 pounds (fraction neglected), and consequently the weight which each buoy can support is 21 pounds. For computing the size of buoy for supporting on its top a weight of 112.5 pounds as given by you, and remembering that the weight of water displaced by a floating body is equal to the weight of the latter, and the weight supported, we have the following formula:

$$W_d = W_f + W_s, \qquad (1)$$

in which W_d = weight of water displaced, W_f = weight of floating body, and W_s = weight of the body supported. The weight of water displaced is equal to the volume of this water in cubic feet multiplied by 62.5; this volume, which we shall denote by V, is unknown, hence for W_d in formula (1) we shall write $V \times 62.5$; the weight of the floating body we shall assume to be 100 pounds, and W_s we know to be equal to 112.5 pounds, hence the formula (1) must be changed to the following:

$$V \times 62.5 = 100 + 112.5$$
$$= 62.5 \; V = 212.5,$$

from which we get

$$V = \frac{212.5}{62.5} = 3.4 \text{ cubic feet.}$$

If we make the length of the cylinder or buoy 3 feet, then the cross-sectional area of the cylinder must be $\frac{3.4}{3} = 1.133$ square feet, which corresponds to a diameter of 1 foot 4 inches very nearly. Hence the buoy should be 3 feet long and 16 inches diameter, all outside measurements. This buoy when completely immersed will support a weight of 112.5 pounds.

(550) G. G., Allegheny, Pa., writes: Please answer the following questions: 1. A steam hammer is working with a steam pressure of 100 pounds per square inch under its piston, which is 24 inches diameter, and having a stroke of 4 feet. The total weight of ram, piston and piston rod is 5 tons. How far will this ram travel upwards after it has traveled 4 feet, at which point the exhaust passage is suddenly opened, and a steam pressure of 100 pounds per square inch is suddenly admitted to the top of piston? 2. Also, how far will the ram travel upwards after having traveled 4 feet, when steam of 100 pounds per square inch is suddenly admitted at the top of piston, while the steam pressure under the piston remains in full force? In all cases you will, of course, assume that the cylinder is plenty long enough so that the piston will not be obstructed by it in its upward flight. The diameter of the piston may be neglected in the computations. Please give the method of computation in as simple manner as possible, so that I can apply it to any case. *A.*—The first step will be to find the stored-up energy in the moving mass at the end of the stroke; to find this we must know the velocity of the moving mass at the end of the stroke, and for finding the velocity we must know the acceleration. The acceleration is found by the following formula:

$$\frac{f}{m} = a, \qquad (1)$$

in which f = effective force in pounds, which causes the mass to move upwards, m = mass, which is equal to the total weight in pounds divided by the acceleration of gravity = 32.2 feet per second, and a = the required acceleration. Taking the total moving weight at = 5 × 2 000 = 10,000 pounds, the mass m will be $\frac{10\,000}{32.2}$ = 310.5. The area of a piston 24 inches diameter is 452.39 square inches, hence the total force acting underneath the piston is 452.39 × 100 = 45,239 pounds; this is resisted by the weight of the moving parts, hence the effective force which moves these parts is 45,239 − 10,000 = 35,239 pounds; substituting this value for f in formula (1), we have

$$\frac{35\,239}{310.5} = a = 113.49.$$

Allowing for friction, we may take 110 feet per second for the acceleration a. The velocity at the end of stroke is now found by the following formula:

$$v = \sqrt{2 \times a \times s}, \qquad (2)$$

in which v = velocity in feet per second at the end of the stroke, s = stroke in feet, and a = acceleration = 110 feet per second, as found above; substituting these values, we have

$$v = \sqrt{2 \times 110 \times 4} = 29.6 \text{ feet per second.}$$

The stored up energy at the end of the stroke is found by the following formula:

$$e = \tfrac{1}{2} m v^2, \qquad (3)$$

in which e = stored up energy in foot-pounds; the other letters denote the same quantities as before. Substituting in formula (3) for the letters their values, we have $e = \frac{1}{2} \times 310.5 \times 29.6^2 = 136028.84$ foot-pounds. The moving parts cannot be brought to rest until this energy has been expended. The resisting force on which this energy is expended is the total steam pressure admitted to the top of the piston, which we have found to be 45,239 pounds, and the weight of the moving parts = 10,000 pounds, making a total of 55,239 pounds. Hence the moving mass will travel, after the steam has been shut off, through a distance of

$$\frac{136028.84}{55,239} = 2.46 \text{ feet.}$$

In the second case the stored-up energy at the end of the stroke is the same; the steam pressure on top of the piston will counterbalance the pressure underneath, hence, if we neglect friction, the only resistance to be overcome will be the weight of the moving parts. Consequently the distance through which the moving parts will travel before the energy is used up, and the whole brought to rest is

$$\frac{136028.84}{10,000} = 13.6 \text{ feet.}$$

In these computations we have assumed that there is no expansion underneath the piston, and that there is no compression due to contracted steam passages.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

New Gear Book free. Grant; see page 12.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Turret Drills, 6 spindles. A. D. Quint, Hartford, Ct.

Fine pat. work. H. Cooper, 118 William St., N.Y.C.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 157 William St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Best Presses and Dies for all sheet metal work, Ferracute Machine Company, Bridgeton, N. J.

Air Compressors for every possible duty. Clayton Air Compressor Works, 26 Cortlandt street, N. Y.

Match machines for sale, splint cutters, coilers & unloaders. I. L. Hawkins, bld'r, Waterbury, Conn.

Our loose pulley oiler saves you labor, annoyance, money. Kridler Mfg. Co., Grand Rapids, Mich.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

Emery, emery wheels, grinding machines and grinders' supplies, quick process and large stock. When in a hurry, buy of The Tanite Co., New York City, Cincinnati, Ohio, and Stroudsburg, Pa.

New Jersey Art Metal Co., Passaic, N. J., finest thin and ornamental castings in brass, bronze, aluminum, etc.; machinery name plates in brass and aluminum.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 post paid. Published by John Wiley & Sons, 53 East Tenth street, New York.

"Modern Locomotive Construction." By J. G. A. Meyer. In this book the design and construction of all details of the locomotive and tender are considered from a practical standpoint. It contains illustrations of details made from working drawings, accompanied by plain directions for designing, and rules and tables for construction. Adapted to office and shop use. Price, $10. Published by John Wiley & Sons, 53 East Tenth street, New York.

Report of Committee on Comparison of Round and Square Test Bars.*

This committee was appointed at the July meeting of the association to investigate the matter of casting round test bars on end, according to the method proposed by Mr. Thos. D. West, of Sharpsville, Pa., as being preferable to the ordinary method of casting square bars flat.

We have followed out our tests with the apparatus furnished by Mr. West and have been guided by his directions, as to details of pouring, etc., thus taking advantage of his experience. The different members have made independent tests, so that this report represents results obtained in several foundries.

A series of nine pairs of tests were carried out to obtain the different properties described in a former paper of Mr. West's, read before the association, on his method of casting round test bars on end. These bars were cast two in a flask and poured from the same ladle of iron at the same time, and are accordingly grouped in pairs. Ten bars of the eighteen were defective.

From these tests it was seen that in the nine pairs of bars, only one pair (No. 8) show a solid fracture. In all the other pairs, either one or both bars show flaws. The effect of these flaws is shown directly in the breaking tests, No. 8 being the only pair that broke practically at the same weight. The percentage of bars in this series which showed flaws is 55½ per cent.

Another series of 11 pairs of round bars was tested for transverse strength, shrinkage and chill. In this series 32 per cent. of the bars showed flaws.

Still another series of tests comparing square bars and round bars was made.

*Report presented at a meeting of the Western Foundrymen's Association, November 21, 1894.

Each set of three bars was cast from the same ladle of iron, the square bars being cast flat in the ordinary way and the round bars on end. In this series the square bars were all perfect, showing no flaws, while of the round bars, there was 43 per cent. defective, on account of flaws.

In a fourth series of tests, comparisons were made with square and round bars, as in third series. In this series the per cent. of square bars defective from flaws is 18 per cent., while of the round bars it is 54½ per cent.

Still another series of tests, made by one of the committee, comparing the square and round bars, showed the percentage of poor bars, in round bars cast on end, to be much greater than in square bars cast flat, but unfortunately the record of his tests was mislaid and we cannot show the actual figures.

Mr. West's plan for determining contraction, fluidity and chill, we find to be good. His plan for shrinkage, as was shown by first series, and in about 100 other bars, not enumerated, shows no uniformity and is impractical.

We are obliged to say that we cannot see anything in the foregoing results that would warrant us in endorsing the round bar, cast on end, as against the square bar, cast flat, for obtaining the transverse strength, which is the most important test in ordinary foundry practice.

The principal difficulty met with is the frequent appearance of flaws (probably due to method of casting) which does not seem to occur to the same extent in square bars, cast flat. These flaws do not appear to be blow holes, or cavities, but rather slag, or sand flaws.

Respectfully submitted for the committee,

O. T. STANTIAL, *Chairman.*

Fifteenth Annual Meeting of the A. S. M. E.

The programme of the Fifteenth Annual Meeting of the American Society of Mechanical Engineers has been announced, and, so far as can be judged from it, the session will be a very interesting and pleasant one. The convention will be opened at 9 P. M. on Monday, December 3d, at which time there will be no presentation of papers, but some topical questions will be taken up for discussion. Meetings during the week will be confined to mornings and evenings as usual, in order that afternoons may be left open for social reunions, or for transaction of such business as members may have on hand in the city or vicinity.

During the various meetings the following professional papers will be read:

"Relative Tests of Cast iron," by W. J. Keep.

"Notes on Steel Forgings," by Geo. M. Sinclair.

"Trials of a Vertical Triple expansion Condensing Pumping Engine at the Trenton Water-works," by Samuel and S. S. Webber.

"Tests on the Triple-expansion Engine at the Mass. Inst. Tech." (Second paper), by Peabody-Miller.

"Trial of a Leavitt Pumping Engine;" "Trials of a Recent Compound Engine with a Cylinder Ratio of 7 : 1;" "Changing the Suction System of a Pumping Engine," by F. W. Dean.

"Tests of the Strength of Spruce Columns," by Gaetano Lanza.

"On the Theory of the Moment of Inertia," by C. V. Kerr.

"Comparison of the Action of a Fixed Cut-off and Throttling Regulation, with that of the Automatic Variable Cut-off on Compound and Triple-expansion Engines;" "Description of a Cam for Actuating the Valves of High-speed Steam Engines;" "Description of an Improved Steam Separator and an Improved Steam Jacket;" "Description of an Improved Centrifugal Governor and Valve," by Chas. T. Porter.

"Stresses in the Rims and Rim Joints of Pulleys and Fly-wheels;" "The Application of Brakes to the Truck-wheels of a Locomotive," by Gaetano Lanza.

"An Experimental Study of the Effect of the Counterbalance in Locomotive Drive-wheels Upon the Pressure of Contact Between Wheel and Rail," by W. F. M. Goss.

"Present and Prospective Development of Electric Tramways," by C. J. Field.

"Relative and Special Tests of Cast iron," by Thos. D. West.

"Rustless Coatings for Iron and Steel," by M. P. Wood.

"The Effect of Clearance on Economy of a Small Steam Engine," by Geo. W. Bissell.

"Results of Experiments to Test the Accuracy of Small Throttling Calorimeters," by D. S. Jacobus.

At the close of each session a luncheon will be served in the lower room of the house, and on Wednesday evening there will be a reception and *conversazione* at Sherry's, Thirty-seventh street and Fifth avenue. The usual programme will be somewhat varied in connection with this function, as the presidential address will be delivered at that time. The sessions will be closed on Friday morning.

The following are among the topical discussions which are set down for the meeting, though to judge from former meetings, it is difficult to tell how many of them will actually be taken up:

"Are there certain general principles underlying the proper connection of steam boilers and engines in a power plant?"

"What form of filing cabinet have you found most convenient for clippings, etc.?"

"What is the nature of the injury done to massive machinery when the building has burned in which it stood?"

"Is it better to have the condenser close to an engine cylinder, or is it a good plan to have a long pipe between them?"

"Can it be made practicable to design a machine which shall unite the merits of both the milling machine and the planer? Is not this problem a paradox in machine construction?"

"For filtering oil having very finely divided metallic particles in suspension, what have you found to be the best filtering material, either for one operation or in a series?"

"What is the economy, if any, of damper regulation in firing with liquid or gaseous fuel?"

"In boilers fired with liquid or gaseous fuel, is there any advantage in simultaneous regulation of the fuel supply and the position of the damper, either by the same or by different mechanisms under the ordinary control of the steam pressure?"

"Are there any conditions under which oil fuel is cheaper than coal for generating steam at points in the Atlantic Seaboard States; if so, what are they, and where?"

"Has any term ever been suggested to discriminate between the elastic resistance offered by a body to a force tending to change its shape and that offered by the same body to a force tending to change its volume? How much of the latter kind of elasticity has India rubber?"

"In a centrifugal pump at constant speed, how is the efficiency effected (a) by throttling the delivery; (b) by a by-pass?"

"In a centrifugal pump receiving water under the head, does the whole amount of the head add to its normal lift?"

"What is the common method and best practice for determining the largest sizes of pipe desirable to use in mill heating, both by live and exhaust steam?"

"In the operation of annealing tool steel, what is the essential or principal condition to be observed to insure the best success?"

"What is the best telephone system for connecting departments of a large works with each other and the central office?"

"What rule is there for determining approximately the horse-power required to drive disk fans for exhausting and ventilating?"

"Has any one found it to pay to exhibit in recent International Expositions, where to do so entails a cost of attendance, transportation and other heavy charges?"

"Is there any reliable method for calculating the cost of one machine if the cost of a large number is known; or, conversely, if you know the cost of one machine, can the cost of building a large number of the same machine be satisfactorily calculated?"

"What information can you give as to the best method for the extraction of oil from condensed steam, where it is desirable to use the exhaust steam repeatedly for boiler feed purposes?"

"Have you had convincing experience in the crystallization of metals due to intermittent strain or vibrating motion?"

It is announced also that the summer meeting of 1894 may be expected to be held in Detroit, Mich., by which is meant, of course, the summer meeting of 1895.

It is expected that there may be considerable interest in the proposed amendments to the rules of the Society, the change pertaining particularly to the manner of classifying and receiving new members, and the object being to enhance the value of membership in both the associates and members' grade. The classification proposed is that of honorary members, members, associates and juniors, the first-named class not to exceed 25 in number. According to the new rules, a candidate for full membership must be not less than 30 years of age, and for an associate not less than 26 years of age. It is understood that this will, however, simply be an amendment of the rules to conform to what has grown to be the regular practice of the Council in considering applications for membership.

The Picture of Geo. H. Corliss.

It seems rather odd that after all the notable things accomplished by Geo. H. Corliss during his lifetime, the question of the control of his photograph should now lead to a notable court decision. It seems that his family wished to stop the sale of a biographical sketch of Mr. Corliss, and failing in this attempted to secure an injunction against the publication of a reproduction of his photograph. In this they also failed. Judge Colt, of the U. S. Circuit Court, at Boston, saying in part:

While the right of a private individual to prohibit the reproduction of his picture or photograph should be recognized and enforced, this right may be surrendered or dedicated to the public by the act of the individual, just the same as a private manuscript, book, or painting becomes (when not protected by copyright) public property by the act of publication. The distinction in the case of a picture or photograph lies, it seems to me, between public and private characters. A private individual should be protected against the publication of any portraiture of himself, but where an individual becomes a public character the case is different. A statesman, author, artist, or inventor who asks for and desires public recognition may be said to have surrendered this right to the public. When any one obtains a picture or photograph of such a person, and there is no breach of contract or violation of confidence in the method by which it was obtained, he has a right to reproduce it, whether in a newspaper, magazine, or book. It would be extending this right of protection too far to say that the general public can be prohibited from knowing the personal appearance of great public characters. Such characters may be said of their own volition to have dedicated to the public the right of any fair portraiture of themselves. In this sense I cannot but regard Mr. Corliss as a public man.

Two Mechanics Return.

W. H. Dayton, of Torrington, Conn., recently returned from Europe, coming over on the "Lucania's" last record-breaking passage. He has spent about three months looking into mechanical matters in England and on the Continent, and while he saw many things to admire there, he thinks that in many respects American practice is far superior, especially in what may be called the tool maker's art.

Speaking of his swaging machine—of which we gave an account in our issue of July 5th—he thought the principal obstacle to its introduction abroad was that the necessary good tool making which must always accompany the use of such a machine was not, except in rare cases, to be obtained there, and in his opinion a great deal of education must precede its full development there—an education which will consume much time, perhaps generations.

Ambrose Swasey, of Cleveland, also returned from a three months' trip to Europe, coming in on the "New York," which had one of the most persistently rough passages ever experienced, and affording Mr. Swasey an excellent opportunity to study various phases of sea sickness. In Europe, he naturally spent a good deal of his time hobnobbing with astronomical instrument makers and astronomers, his fame as the builder of the two largest telescopes in the world having, of course, made him known everywhere. In London, he was the guest of the Royal Astronomical Society, and of a club composed of a portion of its membership.

He also looked into matters connected with tool building, and speaks enthusiastically of the exhibit of machine tools at the Antwerp Exhibition. His general conclusions, however, are practically about the same as those of Mr. Dayton referred to above.

Steam Engine Fly-wheels.

BY WM. R. KALES.

The duty of the fly-wheel of an engine is to act as a reservoir of energy from which power may be drawn, or in which power may be stored at times when the torque produced by the pressure on the crank-pin is less or greater than that required to overcome the load on the engine. Consequently the fly-wheel must always be taking up or giving out work, as the torque varies even when the load is constant, but it is not necessary to make calculations for these changes except in special cases, because a wheel that will take care of the variations in the load will, under most circumstances, be far in excess of that demanded by variations in torque.

Knowing the allowable variation in speed, the amount and rapidity of the variations in load, and the time required by the governor to accommodate itself to the changes, it is possible to calculate the weight of a wheel rim of a given diameter that will keep the speed fluctuations within the prescribed limit.

It is evident that for loads that come on or go off gradually, the governor will keep pace with the changes, and then the wheel needs simply to look after the variations in torque due to the steam distribution, the acceleration and retardation of the reciprocating parts, etc., but in such cases as those presented by rolling-mill and electric railway work, where large and instantaneous variations of load occur, the governor cannot act soon enough. Then it is that the fly-wheel must be able to take up the superfluous power, or make up the deficiency in power, until the governor can have time to reach its proper position.

In this paper it is proposed to work out a formula that shall apply to cases where the greatest variations occur in the instantaneous changes of the load.

Let $H.\ P.$ = the rated horse-power of the engine;

R = the number of revolutions per minute;

D = the mean diameter of the wheel rim in feet;

$\frac{1}{h}$ = the greatest fraction of the H. P. that can be instantaneously thrown on or off in the form of a load variation;

r = the number of revolutions the wheel makes between the time when such a load is thrown off, and the time when the governor rises to a position proper to control the reduced load;

p = the per cent. of allowable variation in speed;

W = weight in pounds of a rim that can take up the superfluous power without speeding up above $R\left(1+\frac{p}{100}\right)$ revolutions per minute.

At the speed R the rim has a linear velocity in feet per second of

$$V = \pi D \frac{R}{60}. \qquad (1)$$

The energy stored in a moving weight is given by the formula

$$E = \tfrac{1}{2} \frac{W}{g} V^2, \qquad (2)$$

where E is expressed in foot-pounds, and where g is the acceleration of gravity in feet per second, 32.16.

$$E = \tfrac{1}{2} \frac{W}{g} \left(\pi D \frac{R}{60}\right)^2. \qquad (3)$$

Letting E_1 represent the energy in foot-pounds when the wheel runs at its upper limit of speed, $R\left(1 + \frac{p}{100}\right)$,

$$E_1 = \tfrac{1}{2} \frac{W}{g} \left\{ \pi D \frac{R}{60} \left(1 + \frac{p}{100}\right) \right\}^2 \qquad (4)$$

Therefore, the number of foot-pounds that can be taken up by the wheel without increasing its velocity beyond the allowable limit is

$$E_1 - E = \tfrac{1}{2} \frac{W}{g} \left(\pi D \frac{R}{60}\right)^2 \left\{ \left(1 + \frac{p}{100}\right)^2 - 1 \right\}$$

$$= \tfrac{1}{2} \frac{W}{g} \left(\pi D \frac{R}{60}\right)^2 \left(\frac{2p}{100} + \frac{p^2}{10{,}000}\right). \qquad (5)$$

Now from the conditions stated above, the superfluous energy in the greatest variation that can take place before the governor adapts itself to the load is equal to

$$\frac{H.P. \cdot 33\,000 \cdot r}{R \cdot h}.$$

Placing this equal to $E_1 - E$, we have

$$E_1 - E = \frac{H.P. \cdot 33{,}000}{R \cdot h} r = \tfrac{1}{2} \frac{W}{g} \left(\pi D \frac{R}{60}\right)^2 \left(\frac{2p}{100} + \frac{p^2}{10{,}000}\right). \qquad (6)$$

Solving for W,

$$W = \frac{H.P. \cdot 33{,}000 \cdot r \cdot 60^2 \cdot 100 \cdot g \cdot 2}{R^2 \cdot h \cdot \pi^2 \cdot D^2 \cdot \left(2p + \frac{p^2}{100}\right)}$$

$$= \frac{H.P.}{R^2 D^2} \times \frac{r}{h \left(2p + \frac{p^2}{100}\right)} \times$$

$$\frac{33\,000 \times 60^2 \times 100 \times 32.16 \times 2}{3.1416^2}$$

$$= \frac{H.P.}{R^2 D^2} \cdot \frac{r}{h \left(2p + \frac{p^2}{100}\right)} \cdot$$

$$77{,}630{,}000{,}000 \qquad (7)$$

As will be seen, the factor $\frac{r}{h \left(2p + \frac{p^2}{100}\right)}$ depends upon the character of the governor, the magnitude of the variations in the work the engine is to perform, and the allowable speed fluctuations. A designer can readily simplify the formula by calculating this expression for each of the several classes of work that his engine is to perform, and he will then have for each case a formula like the one below,

$$W = \frac{H.P.}{R^2 D^2} C$$

in which C is a constant.

For instance, suppose that one-half of the full engine load can be instantaneously thrown off, that the fluctuations in speed must not exceed 2 per cent., and that it will take two full revolutions of the engine before the governor can reach its proper position. In this case,

$$h = 2$$
$$p = 2$$
$$r = 2$$

and the factor becomes,

$$\frac{2}{2\ (4 + .04)} = \frac{1}{4.04}.$$

For such conditions the formula becomes,

$$W = \frac{H.P.}{R^2 D^2} 19{,}200{,}000{,}000.$$

As an example, suppose we have a 500 horse-power engine with an 18-foot wheel running at 100 revolutions per minute.

$H.P. = 500$
$R = 100$
$D = 18$

$$W = \frac{500 \times 19{,}200{,}000{,}000}{100^3 \times 18^2} = 29{,}600 \text{ lbs.}$$

In making up this weight, the arms of the fly-wheel should be allowed at one-sixth their actual weight, and an allowance should be made for the weight of driven wheels; the metal in the rim of a driven wheel being as valuable as that in the rim of the fly-wheel, if the driven rim travels at the same linear velocity.

A study of formula (7) shows the important part played by the speed of the wheel; for to control the same fluctuations of load with the same diameter of wheel very nearly twice as much weight is required at 80 as at 100 revolutions per minute.

Furthermore, the advantage of a sensitive and quick acting governor gear is shown by the fact that the wheel weight is proportional to the number of engine revolutions that the governor requires to make its movement.

Identical equations may be deduced by supposing the engine to be suddenly loaded down instead of unloaded.

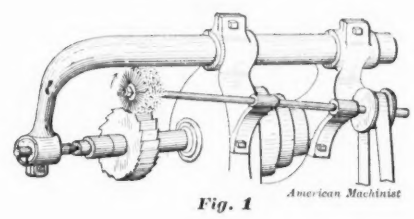

Fig. 1

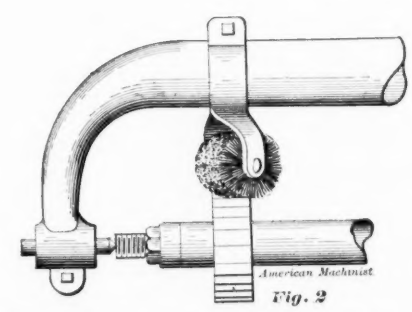

Fig. 2

Brush Arrangement for Milling Cutters.

While milling machines are forging ahead, and are receiving so much attention, both by your readers and writers, I wish to speak of an attachment recently brought to my notice, for clearing a cutter of its chips. It was an improvised affair, and perhaps has been employed before, but to me it is new, nor do I know of any machines being built with a provision of this kind.

I suppose it is a common experience that when a deep cut is taken in either wrought-iron or steel, the cutter is liable to become clogged with the cuttings, the effect of which is to heat it, and produce bad work. The simple remedy, of course, is to clear away the chips with a hand brush, but in the case referred to, the operator relieved himself of this work by employing a rotary brush, and connected it in the manner shown by my sketch, Fig. 1. The rod to which the brush attaches is but $\frac{5}{16}$ inch diameter, and is set at an angle with the spindle of about 30 degrees. The brush revolves somewhat faster than the cutter, and in the direction of the arrow; most of the cuttings are thus thrown off at the rear of the table. Motion is derived from one of the feed cones, a $\frac{1}{2}$-inch belt of lace leather being sufficient to drive the brush.

Builders of milling machines could evidently improve on the scheme I illustrate; in fact, most of this could probably be dispensed with, either by causing a brush to roll on the cutter at an angle of, say, 45 degrees, as shown by Fig. 2, or perhaps a reciprocating brush would be preferable.

Not to ignore the value of pneumatic appliances, I would suggest that a very small and comparatively light air jet might be used to advantage in clearing away cuttings when the spaces are disposed to fill up.

"QUIRK."

Why Does a Bicycle Stand Up?

BY J. BEGTRUP.

It is no doubt true that a bicycle rider can and often does balance himself by manipulating the wheel so as to run it under the center of gravity, but he does not generally depend on such manipulation to preserve equilibrium, as is the opinion expressed by Mr. Oberlin Smith in your issue of November 15th.

I think that most bicycle riders will admit that a great deal of riding can be done without turning the handle at all, and I think that such manipulation of the wheel is only resorted to occasionally by the experienced rider when running slow or when turning a curve. I do not think Mr. Oberlin Smith has answered the question in relation to stability of a bicycle rider fully; in fact, I think he has missed the main point.

The stability of a rolling wheel does not depend on human skill or instinct—it will stay upright whether there is a human being on top of it or not; the upright position is the "natural" position for a rolling wheel; this, I think, is known in a general way to any one who has had occasion to roll a wheel or hoop. A wheel can be rolled on any ordinary road by giving it an occasional push to keep up the speed; it will not only be simply in balance, it will be in "steady balance," for if it hits an obstruction in the road which throws it a little to one side, it will immediately swing to the other side, and after a few small oscillations recover its upright position, just as a pendulum will regain its perpendicular position after having been disturbed. The natural position for a thin circular disk is horizontal when at rest and vertical when rolling. To prove this, take any thin coin and try to make it stand up on its edge; this will soon convince the experimenter that the first part of my assertion is correct. Then hold the coin *nearly* vertical, and throw it along the table in any manner whatever except at right angles to its own plane, and it will invariably obtain a rolling motion if thrown with sufficient force; if held so that its plane is nearly in the direction of motion, it is impossible to throw it without making it roll, and thus I think the second part of my assertion can be proven experimentally. The coin can also easily be made to perform small lateral oscillations while running, which proves it to be in stable equilibrium. But why is it in equilibrium? If the coin has its plane initially inclined to the vertical, and is properly started, it will describe a curved path whose curvature depends on the amount of inclination, and in this circumstance lies the secret of stability of a rolling wheel, which I shall presently explain.

But first I would like to explain why the inclined coin rolls in a curve. It is an undeniable fact that it does so, but we would like to know why. If we imagine the coin to make an exceedingly small impression on its support, it is evident that this impression would be slightly curved when the coin leans to one side, and such impression being an increment of the track, it is clear that the track will be curved. The impression may be so infinitely small that this explanation would seem insufficient, but it is the best I am able to give.

If something happens to the rolling wheel which throws it over to one side, the lower part which is in contact with the ground will immediately start on a curved track, while the upper part on account of its inertia will push straight ahead; this action of the upper part will straighten up the wheel and throw it to the other side, and the action may be repeated in the opposite direction; the wheel will not be allowed to fall to either side—it is in "dynamical equilibrium."

That the equilibrium of a rolling wheel depends on an action between the wheel and the supporting surface, can be shown by a little experiment with the coin. Put a board in an inclined position, and project the coin along a horizontal line on the incline, it can then be seen by a careful observer that the coin rolls with its plane at right angles to the incline, which shows that a rolling wheel will always have its plane perpendicular to the surface it rolls on when it moves in a straight line, no matter what the relative direction of gravity may be. This is the natural position for a rolling wheel, but a bicycle rider can, of course, make it stand straight up by throwing his weight to one side, and turning the wheel so as to run straight ahead. When a wheel rolls on a curve it is always leaning a little toward the center of the curve; it is thus compelled to describe a curve by its contact with the ground, while the inertia of its mass is opposed to curvilinear motion; this is the kind of inertia called centrifugal force. Gravity will draw the wheel inward, while centrifugal force will pull it outward, and the wheel is in equilibrium under the action of these two forces; if gravity should prevail over centrifugal force, the radius of curvature would be smaller; this would increase the centrifugal force, which is inversely proportional to the radius of curvature; likewise, if centrifugal force should prevail over gravity, the radius of curvature of the path would be greater, and centrifugal force would decrease in the same proportion; the natural radius of curvature of the path of a rolling wheel is, therefore, dependent on the velocity of the motion. This can easily be verified by experimenting with the rolling coin, for the curvature will gradually become smaller when the coin loses its velocity, and the path will be a spiral line.

When a mass is mounted on top of a rolling wheel the dynamic stability of the combined mass will be greater than that of the wheel itself, for the position of the center of gravity is higher, and the action of gravity will therefore be slower, and any disturbing force caused by contact with the ground will be less effective on account of the longer distance to the center of mass.

The stability of a bicycle rider is much like the stability of a skater; while it is rather difficult to stand still on one skate, it is very easy to slide along on it. When a bicycle rider runs down hill he has nothing to do but to keep his wheel steady, which also seems to prove the correctness of my theory.

The resistance to a change of plane of motion is of some consequence when running fast, but generally, I think it amounts to very little. Such resistance does not give absolute stability; it only delays the fall; the gyroscope makes some resistance to being moved to another plane of motion, but after it has been moved, it does not return to its original position; this, apart from other considerations, shows the great difference between gyroscopic stability and the stability of a rolling wheel.

Mr. Geo. F. Simonds, formerly of Fitchburg, Mass, but who had recently resided in Boston, was killed by the cars at Scranton, Pa., November 7th. Mr. Simonds was the inventor of what is known as the Simonds rolling process, of which we have given accounts in our columns, and by which steel balls for ball bearings, track bolts, screws of various forms, and many other small forgings are produced by straight reciprocating dies, rolling the material between them. Mr. Simonds had also done much work in the direction of the development of ball bearings for machinery, and was interested in processes of hardening and tempering articles of steel without deformation.

At the time of his death he was 52 years of age, and had by his devotion to business and his work attained to a highly respected position in the community in which he lived.

During a recent visit to the shops of the Garvin Machine Co., in New York, we found a full complement of men at work, and engaged mainly upon special machinery for use in manufacturing bicycles. Some very interesting machines are being devel-

oped in this line, of which we may be able to give particulars later. Among them are special forms of screw machines or forming lathes for making bicycle wheel hubs, machines for drilling and reaming the links of bicycle chains, automatic machines for making small studs and nipples, and for threading spokes. Though the company have engaged allotments of space at the coming Cycle Show in New York, they state that it now seems probable that they will be unable to fill the space with machinery, as the demands from bicycle manufacturers are so great that they are unable to accumulate stock, and they think it better to fill orders with the machinery which would otherwise be exhibited.

MANUFACTURES.

The Senyear Knitting-mill at Pittsfield, Mass., will be enlarged.

The Success Knitting-mill at Cohoes, N. Y., is being extensively enlarged.

About $5,000 has been appropriated to light Attleboro, Mass., by electricity again.

James Simpson & Co., silk manufacturers at Paterson, N. J , may establish a similar mill at Pittston, Pa.

Congressman Wolverton, of Simbury, Pa., is interested in a project to establish at that point a large silk-mill.

A new 38x30-foot dyehouse is being erected at the Ray Woolen Company's plant at North Bellingham, Mass.

A $150,000 stock company has been looking over the Sewall Falls property, Concord, N. H., with a view to possibly establishing a factory there.

Elkins, Errett & Garrecht, of Philadelphia, Pa., will organize a $30,000 stock company, and establish the manufacture of cement at Phillipsburg, N. J.

The Fitchburg (Mass.) Manufacturing Company has secured the Mitchell Mill, also at Fitchburg, and will establish therein the weaving of ginghams.

It is reported that M. C. D. Borden, of the American Print Works and Iron Works Mill, of Fall River, will erect a number of large cotton storehouses.

A $50,000 stock company will be organized to establish the manufacture of cotton and woolen goods at Laredo, Texas. T. W. Dodd is interested.

The Plymouth Air Rifle Company, of Plymouth, Mich , is looking for a location for a factory in the East, and has been considering Derby, Conn., as a good place.

The business which the late Geo. F. Simonds had been engaged in developing for the past six years, is being carried on by the Ball Bearing Co, 32-33 India Wharf, Boston, Mass.

The Berlin Iron Bridge Co., of East Berlin, Conn., have just completed for the Baldwin Locomotive Works, of Philadelphia, steel roof trusses for the addition to their wheel shop.

Mr. Olsen, of the Indianapolis (Ind.) Bolt and Machine Works, says the trade is improving with them somewhat. The railroads are buying a good many bolts and their elevator trade is good.

The Indianapolis Bicycle Chain and Stamp Company report business as setting in earlier than usual. It now has 105 people at work, against 65 one year ago, and by January 1st expects to be working its full complement of hands.

A new mill is shortly to be erected at the north end of New Bedford, Mass., for the manufacture of coarse yarns. The new mill will be about 300 by 150 feet, one story high. The capital stock is to be $100,000, one-half of which has been subscribed.

The United States Metal Polish Company, of Indianapolis, Ind., is steadily increasing its production. It furnishes all the polishing material for the Pullman Company, and in addition to large home trade is doing considerable export business.

The Lodge & Davis Machine Tool Co., Cincinnati, Ohio, have published a poster which is devoted to the illustration of their various forms of the universal and plain milling machines. It is of interest to mechanics, and will be sent upon application.

A recent letter from M. L. Andrew & Co., Cincinnati, Ohio, says: "AMERICAN MACHINIST, please accept our thanks for a very nice order for our chucks and drilling device from Demerara, Government of British Guiana. Also a nice order from Manchester, England."

There has been a decided improvement in business with the Atlas Engine Works, Indianapolis, Ind. Since November 1st the company has shipped to different parts of the country 27 car loads of engines, on one day shipping 12 car loads, as shown by the switching service records.

The Ames Manufacturing Company, Chicopee Falls, Mass , has taken the contract to make 3,000 bicycles for the Spalding Company during the coming winter. The Ames Company is to discontinue the manufacture of the new mail machine, another firm having underoid them for this contract.

President Hooper, of the Sinker-Davis Works, Indianapolis, states that when the times are good they employ 175 men, but in the depressed times got down to 110 men, and worked but eight hours. They have now got back to 140 men and are working nine hours, and he thinks the situation brightening.

The Jeffrey Mfg. Co., of Columbus, Ohio, are working their full force of men 60 hours per week on orders. They are increasing their capacity very largely, and have closed a contract with the Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, for several of their engine lathes and drill presses.

The Clayton Air Compressor Works, 26 Cortlandt street, New York, are sending out a sheet giving a list of the various uses for which compressed air is employed. This gives a good idea of the work being done by it, and will be found interesting to mechanics. It is sent to those interested on application.

The Windsor Locks (Conn.) Steel Company's plant was sold recently by E. N. Sperry, of Bridgeport, the receiver of the company, acting under orders of the United States District Court. The highest bid was $19,900, made by Farrist & Windsor, of Bridgeport. It is reported that other parties will lease the plant and operate it.

An agent for a syndicate for Chicago firms secured two large contracts in Japan. One goes to Armour & Co., and is for canned beef to be supplied the Japanese army. The other is a $370,000 contract for cast-iron pipe, to be used in extending the Tokio water-works. The pipe will be made in Alabama. The American firm met the competition of English, French and Belgian bidders.

The City Council, of Bessemer, Alabama, has closed a contract with the Bessemer Land and Improvement Company by which the city buys the water-works from the company for $125,000, and the company agrees to expend that amount and $200,000 more in the erection of a steel plant. The company's officers say that work on the steel plant will begin at once. It will be the first plant of its kind in this district.

The Maine Manufacturing Company have removed all of their machinery from the Fairfield (Maine) mill to their new plant in Nashua, N. H. The vacated mill has been leased to a company of local capitalists, who will take possession about December 1st. Harry Britton and M. D. Stratton will be the managers. Just what they will manufacture is not fully decided, but manufacturing boxes will be a part of their work.

A Pittsburgh dispatch says: The puddlers employed in the Wayne Iron Works, of Brown, Sons & Company, of this city, have been notified that beginning November 19th the rate for puddling would be advanced 10 per cent. They are now paying $4 per ton, the highest rate in the district, and with the advance will pay $4.40. The advance was voluntary and in fulfillment of the firm's promise made last spring, when the reduction in puddling took place.

The Berlin Iron Bridge Co., of East Berlin, Conn., will furnish the new power station for the United Electric Light and Power Co., on East Twenty-eighth street, New York City. The power house is 100 feet wide and 200 feet long; the engine room is 100 feet wide. and 80 feet long, and the boiler room is 56 feet wide and 100 feet long, the whole covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron roofing. The coal pockets in the boiler room have a capacity of 3,000 tons.

The bicycle manufacturers are getting matters in shape to begin work on a large scale. Their manufacturing season begins November 1st, and then it is pushed until June, as it is necessary to have a large stock on hand in the spring of the year to accommodate the rush of trade. Both of the larger establishments here construct bicycles in lots of one thousand, and it requires sixty days to complete a bicycle in all its parts. As one lot is partially constructed another thousand is begun. The three bicycle works at Indianapolis will this winter furnish work to about six hundred men. —*Indianapolis Journal.*

It is reported that ground will shortly be broken at New Kensington, Pa., for the foundations of a tin plant, which, when completed, will, it is said, be by far the largest tin plate works in the United States. The site of this big establishment is a piece of ground embracing ten acres and adjoining the property of the Excelsior Glass Com-

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by our different appliances. If you would know more about them, or, if you have any difficult problem in that line, write us, as we have made it our specialty for years.

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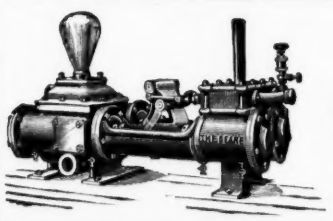

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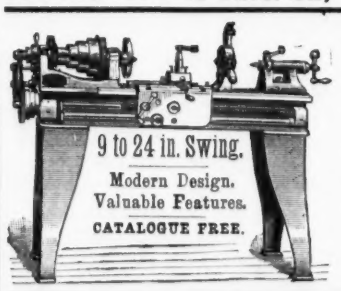

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pany on the Allegheny River front. The projector of this new enterprise is the firm of Goldsmith, Lowenberg & Co., of Portland, Ore., and New York City. When completed, it is said, the works will have cost over $300,000.

The Ellwood Ivins Tube Company's mill, at Oak Lane Station, Philadelphia, Pa., is running 24 hours a day. Two gangs of men are employed. The day men work from 7 A. M. till 6 P. M., and the night hands come on at 6 P. M. and work till 7 in the morning. They report that contracts are in hand to keep them running in this way for nine months to come. This plant now covers over an acre and a half of ground, and even this is inadequate, and preparations are being made to build an addition that will more than double the output. They make tubing from 5 inches in diameter down to a size as is possible to make, and claim that no other makers in the world produce the same range of sizes.

Judge Clayton, of Westchester, Pa., has ordered the sale of the Wellman Iron and Steel Company's extensive plant, the affairs of which have been in the hands of a receiver for some months. The judge instructed the receiver, William B. Broomall, to sell the plant within four weeks or on Saturday, December 15th. Attorney G. T. Bispham, who represented the creditors to the amount of $450,000, informed the court that he had completed arrangements to re-organize the plant by putting $175,000 of new money into it, and paying the unsecured creditors in preferred stock. If the arrangements were completed he would pay $20,000 to secure the interest on bonds.

The Tradesman, Chattanooga, Tenn., in its report on the industrial condition of the South for the week ending November 19th, says: Information from all parts of the Southern States is that a strong feeling of confidence is growing up, and that business generally is being conducted on a larger scale than heretofore. Immigrants are coming into Tennessee, Georgia and Alabama in greater numbers than ever before. Lumber producers report improvement in business, and that organizations among them are increasing in numbers. No change is to be noted as to iron production. The market continues to absorb the supply. Southern textile mills are working to their fullest extent, and with favorable prospects. Thirty-seven new industries were established or incorporated during the week, among which are: Steel works at Bessemer, Ala., by the Bessemer Land and Improvement Co., estimated to cost $1,300,000: the Sawyer Gold Mining Co., of Ashboro, N. C., capital $900 000; a cotton-mill to cost $100,000 at Greenville, S.C.; the Roosevelt-Wheless Car Coupler Co., of Houston, Texas, capital $100,000; the Consumers' Ice Co., of Wheeling, W. Va., capital $50,000; a $30,000 box factory at Vicksburg, Miss.; a $20,000 phosphate plant at Brooksville, Fla., and a $10,000 spoke factory at Meridian, Miss. There is also reported a canning factory at Key West, Fla.; a cotton-mill at Chattanooga, Tenn.; a cotton compress at Waco, Texas; electrical plants at Malvern and Rogers, Ark., Athens and Columbus, Ga., and a flouring-mill at Greensboro, N. C. Knitting-mills are reported at Winston, N. C., and Elizabethton, Tenn.; railway machine shops at Darien, Ga; iron mines near Birmingham, Ala.; a gold mining company at Canton, Ga., and a coal mining company at St. Joe, Ark.; phosphate plants at Fitzgerald and Inverness, Fla., and woodworking plants at Birmingham, Ala., Baxter, Ark., Sampson City, Fla., Worth, Ga., Meridian, Miss., Brower's Mills and Scranton, N. C., and Fredericksburg, Va. Water-works are to be built at Marion and Mobile, Ala., and Ceredo and Kenova, W. Va.

Machinists' Supplies and Iron.

NEW YORK, November 24, 1894.

Iron—American Pig—We quote standard brands, $12.25 to $12.50 for No. 1; $11 to $12 for No. 2. Southern brands, $11.50 to $12 for No. 1; $10.50 to $11.25 for No. 2; $10.25 to $10.75 for No. 3; $10.75 to $11 for No. 1 soft; $10.50 to $10.75 for No. 2 soft; and Foundry No. 4, $10 to $10.40.

Antimony—The market is steady with a fair demand. We quote L. X., 8⅝c. to 8¼c.; Cookson's, 9c. to 9⅛c.; Hallett's, 7⅛c. to 7⅝c.; and U. S. French Star, 9¼c. to 9½c.

Lard Oil—Prime City we quote at 56c. to 57c.

Copper—The prices are lower with a better demand. Lake Copper can be bought from second hands at 9 50c. to 9⅝c. Casting Copper is held at 9c. to 9,10c.

Lead—There is no change in the market. The quotations are 3.12½c. to 3 15c. for New York delivery.

Spelter—The market is weak, and prices are lower. The quotations are 3⅜c. for New York delivery.

Tin—The prices have a downward tendency. For prompt delivery 14.20c. is asked, and futures are quoted at the same figure.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Position as mach. Box 52, AM. MACH.

Situation wanted by competent mechanical draftsman. Address Box 93, Springfield, Mass.

Wanted—Position of foreman boiler maker or layer out; best of refs. D. G., AM. MACHINIST.

Mass. Inst. Tech. graduate in mechanical eng., wants position. Address Box 163, Taunton, Mass.

Wanted—Pos. by draftsman with tech. education and four yrs' exp. Mechanical, AM. MACHINIST.

Wanted—Position by mechanical draftsman, exp. on pumps, sugar and general machinery. A1 reference. Box 55, AMERICAN MACHINIST.

Wanted—A position on some R. R. by tech. grad. who has had 3 years' exp. in a locomotive repair shop, good refs. Box 51, AMERICAN MACHINIST.

If you are manufacturers and want a good traveling salesman having experience, trade, and A1 refs. Address Want, care AMERICAN MACHINIST.

Wanted—Sit. by a machinist thoroughly competent on tool work, engine work pref'd; can read all drawings; best refs., age 24. Box 53, AM. MACH.

Draftsman, graduated from a technical school (Swede) with drawing room and shop experience, wants position. Box 54, AMERICAN MACHINIST.

Wanted—Foremanship of mach. shop; gas eng. shop pref'd, draftsman, good refs, age 35. A. M. S., AMERICAN MACHINIST

Wanted - By a thoroughly reliable American, a steady sit. making mach'y or stove pat'ns; state wages, cost of board, and length of employment. Pattern Maker, 105 Otis St., E. Cambridge, Mass.

Young man with several years experience in drafting room and shop, with knowledge of modern machine shop methods, would like pos.; foreman of small shop pref'd. Work, AM. MACH.

[*Continued on Page* 14]

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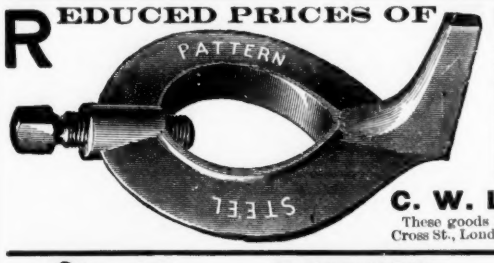

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No.	INCH.	PRICE.	No.	INCH.	PRICE
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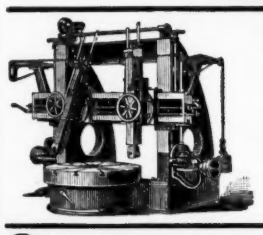
2	½	.35	Small set of 8—5.50		
3	¾	.50	9	2½	1.40
4	1	.60	10	3	1.50
5	1¼	.75	11	3½	1.70
6	1½	.85	12	4	1.90
7	1¾	1.00	Full set of 12—12.00		

C. W. LeCOUNT, South Norwalk, Conn.

These goods are for sale by CHAS. CHURCHILL & CO., L't'd, 21 Cross St., London, England.



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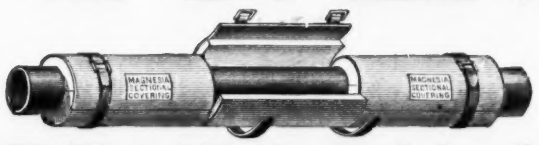

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Denver, C W. Badgley & Co., 18th & Market Sts.
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In order to reduce stock before our annual stock-taking, we have decided to make special LOW PRICES on such new and second-hand tools as we have in stock, if ordered on or before January 10, 1895. WE MEAN BUSINESS. Send for list and state what tools you are in the market for.

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BUILDERS IRON FOUNDRY,

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All common sizes in stock. Catalogue mailed on application.

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Drill Press, 40 in. swing, new.
Engine Lathe, 24 in. x 25 ft. bed, 2d hand.
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Haskin Vertical Engine, 9x9, "
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Open-die Bolt Cutter, ¼ to 1¼, "

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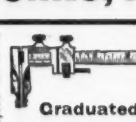

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Using them results in Better and More Work!

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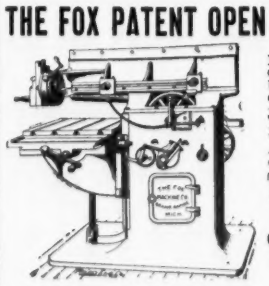

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The Fox Machine Co.,
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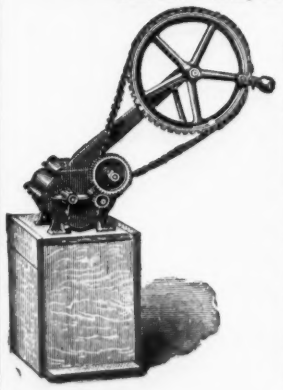
ROOTS' NEW ACME HAND BLOWER.

For Blacksmiths, etc. Slow Speed, Positive Blast. Is Durable, Compact and Cheap; also Portable Forges, Tuyere Irons and Foundry Blowers.



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✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Any one desiring the services in any capacity of a thorough mechanic, having 12 years exp. in designing and building successful modern mach'y and special tools, with special exp. in electrical mach'y, please address Box 57, AM MACHINIST.

As business manager of machine works. Wanted a first-class pos. by gentleman who is thoroughly practical in all the departments, able and reliable in business matters; 30 years exp., covering many lines of machinery; unexceptionable references. R. Wadsworth, 801 63d street., Englewood, Ill.

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Man (35) is open for engage't as mgr., asst. mgr., or supt. with mfr. of ornamental & structural iron. Grad. mech. eng'r, prac. mach., 2 yrs. in drafting room, & 4 yrs. mgr. of ornamental iron works in the South. Reason for change, wants to return North. Prefers New York or Boston. Box 56, AM. MACH.

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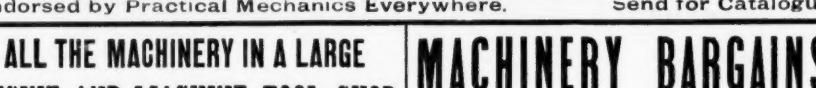

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Jones & Lamson 2 x 24 Flat Turret Lathe with large assortment of Tools. A1 order.
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Brainerd No. 3 Standard Universal Milling Machine complete, with Universal 16 in. Centers, Cutters, Arbors, etc.
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Engine Lathes, "Prentice," "Flather," "Lodge & Davis," "Gleason," Putnam and "McMahon" Sizes 14 to 30 in. swing.
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Planers, sizes 16 to 32 in. wide.
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Patternmakers' Tools, Saws, Lathe and Planer, Cutter Reamer and Tool Grinders.
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24 " 4, 5 and 6 ft. Planer.
28 " 5 and 8 " "
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60 " 20 " "
72 " 25 " "
9 12, 16 24 and 26 in. Stroke Shaper.
10 in. Stroke Slotter.
Hyd. Rivetting Machine.
" Crane, Both A1.
Punch and Shear.
Plate Planer
Hor. Flange Punch No. 2 H. & J. Thomson Bevelling Shear.
15 Swing 6 and 8 ft. Eng. Lathe.
16 " 5, 6, 7 and 10 ft. Eng. "
18 " 6, 7 and 8 " "
20 " 5, 6, 7, 8 and 10 ft. "
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25 " 16 and 24 " "
32 " 16 " "
52 " 35 " "
57 in. Double Head Driving Wheel Lathe.
88 in. x 20 ft. Engine Lathe.
Bement Car Axle Lathe.
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No. 1, 2 and 2½ Screw Machs, P. & W.
No. 1 Lincoln Pattern Miller.
Hand Millers. Screw Slotters, Mill and Cutter Grinders.
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80 200 lb Helve Ham'r, Bradley.
200 lb. Upright " "
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TO BUY FOR CASH.

First-class Second-hand Engine Lathes, Planers, Drill Presses, Shapers, Milling Machines, etc., address,

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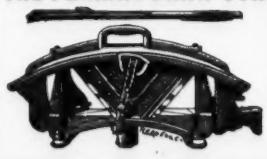

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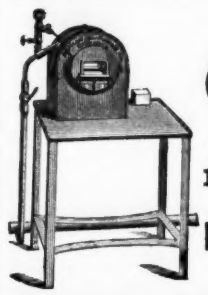

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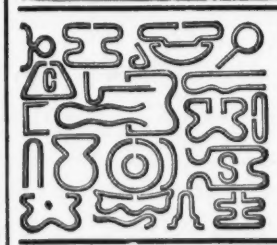

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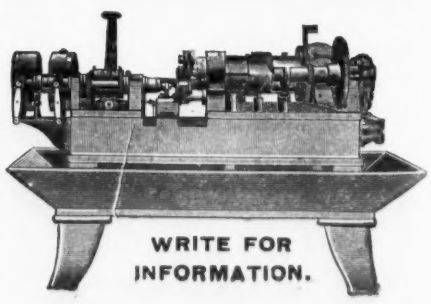

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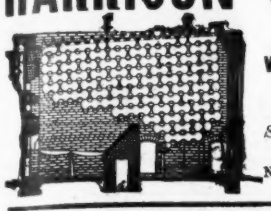

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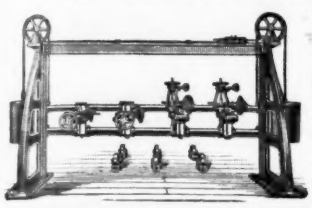

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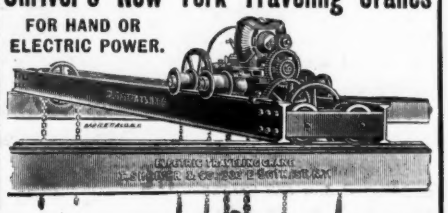

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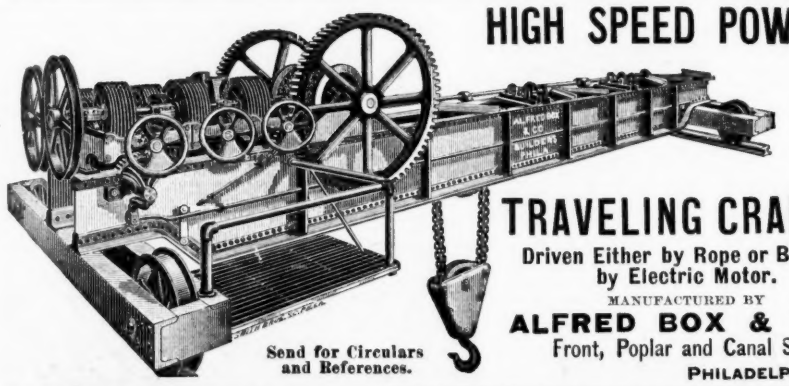

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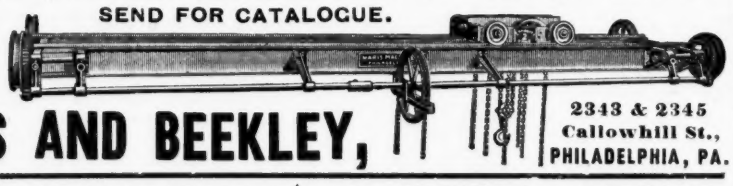

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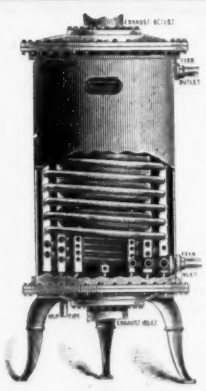

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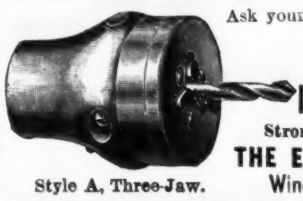

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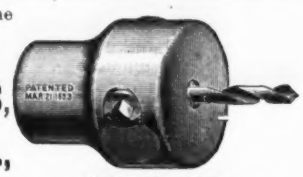

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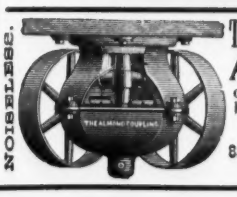

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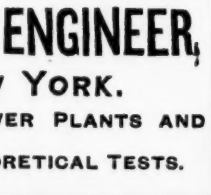

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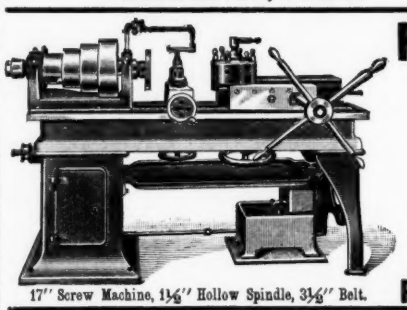

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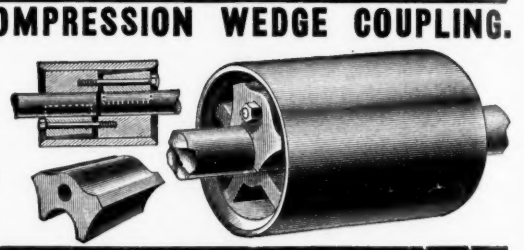

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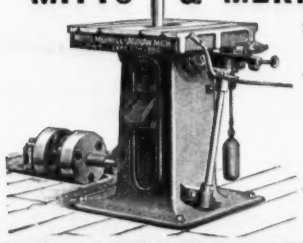

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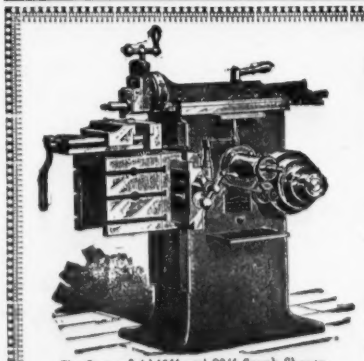

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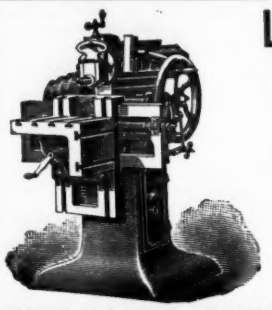

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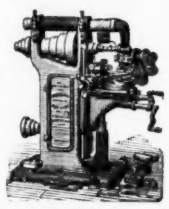

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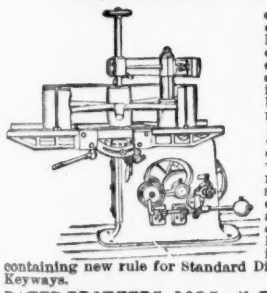

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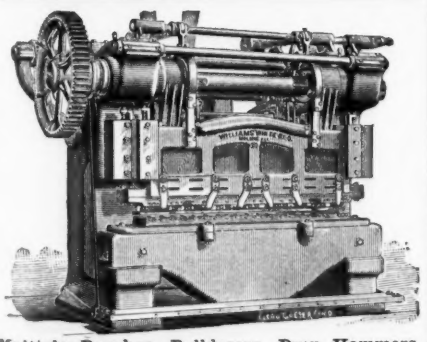

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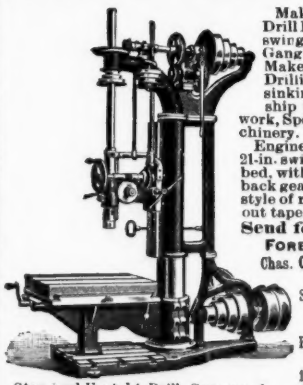

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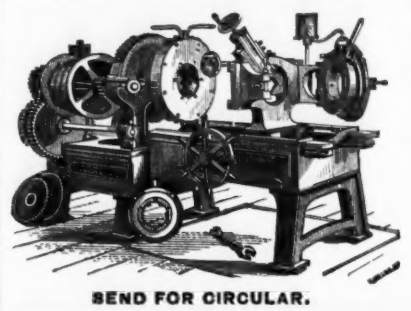

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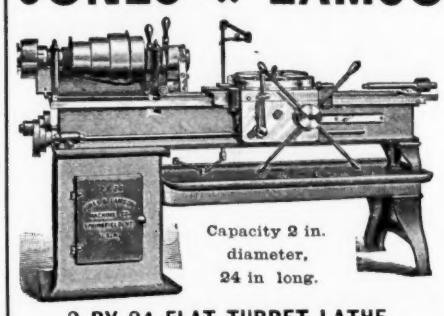

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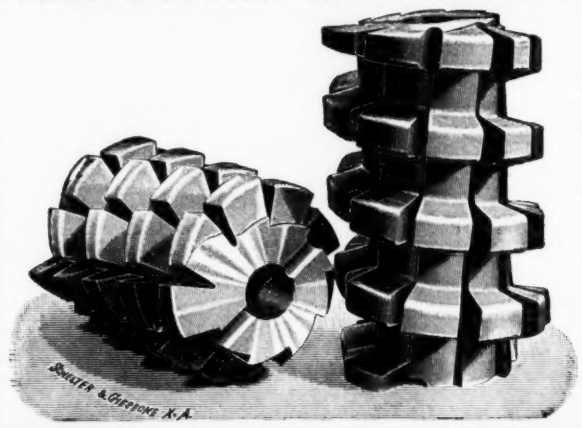

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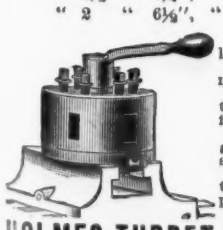

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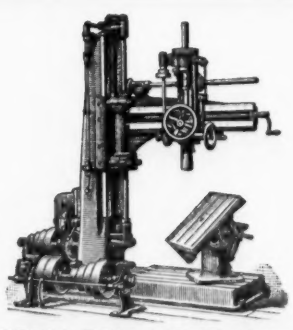

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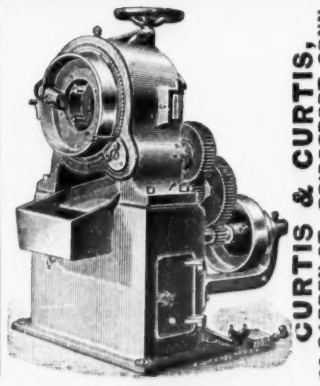

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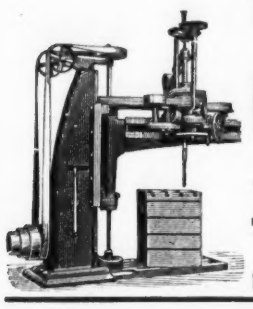

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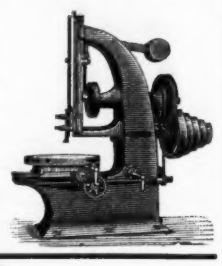

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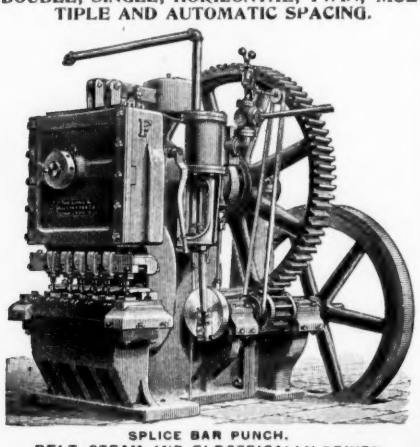

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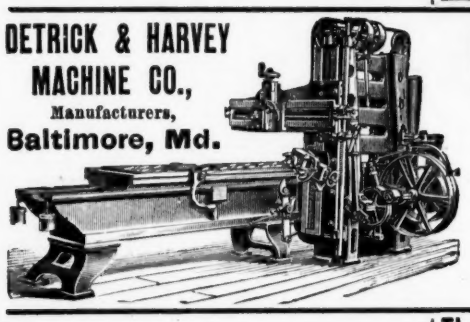

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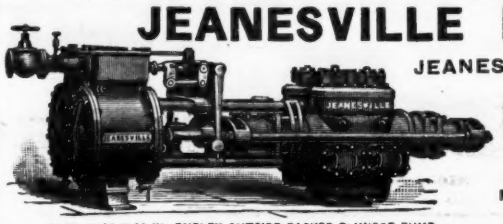

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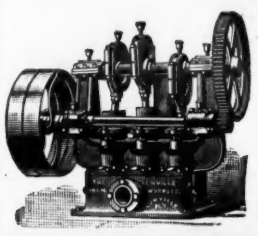

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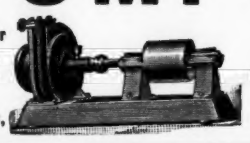

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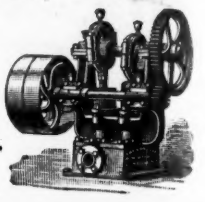

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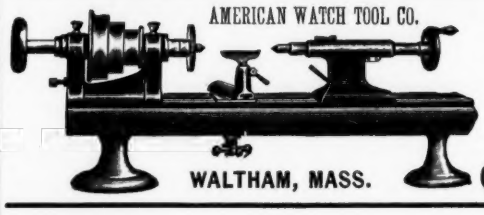

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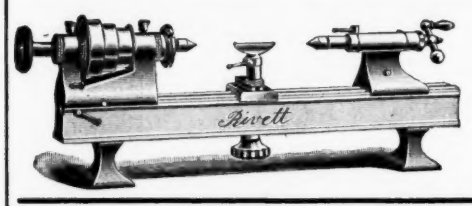

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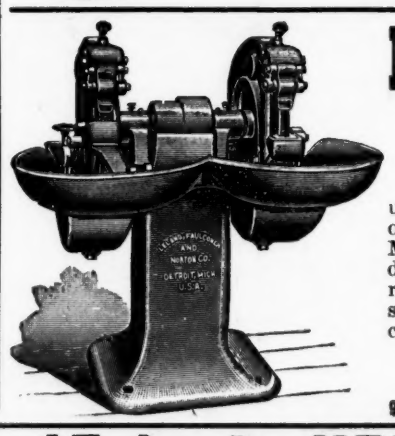

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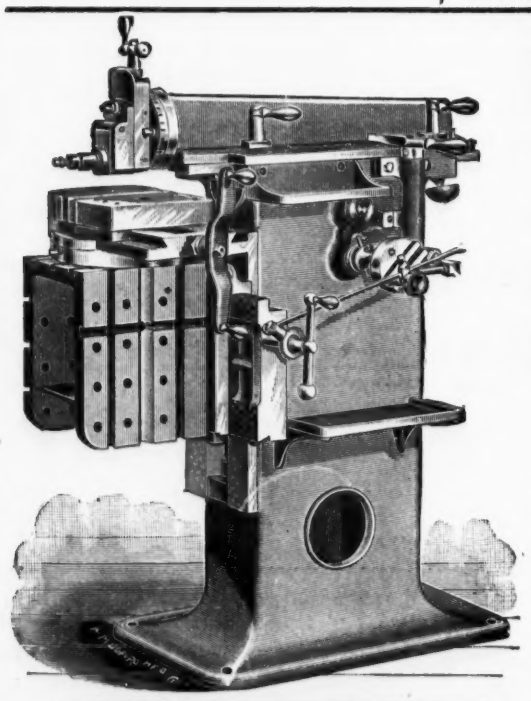

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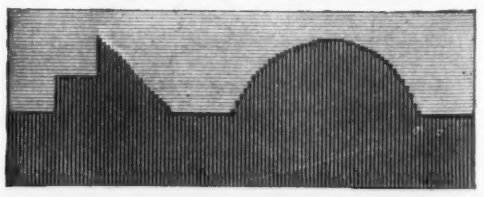

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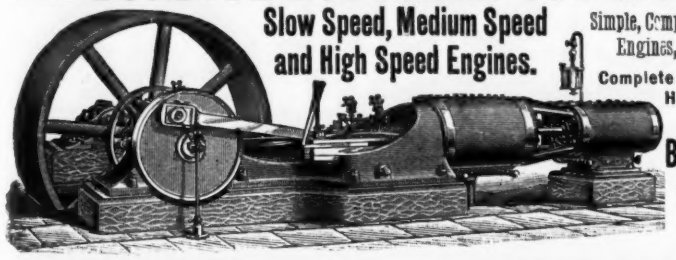

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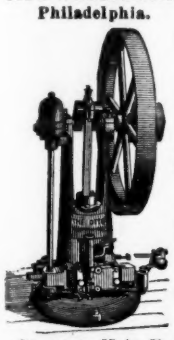

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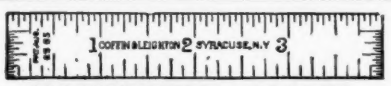

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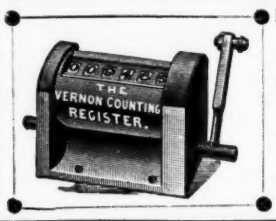

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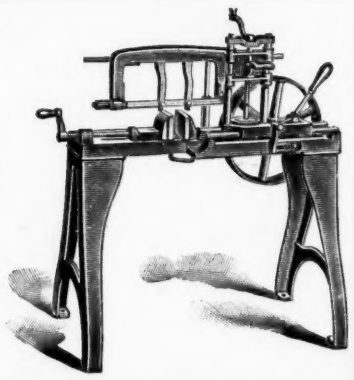

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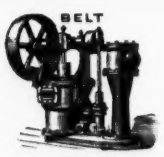
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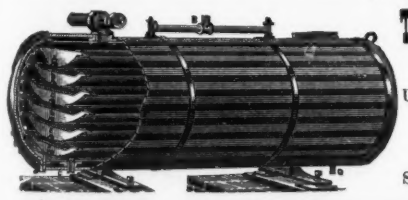

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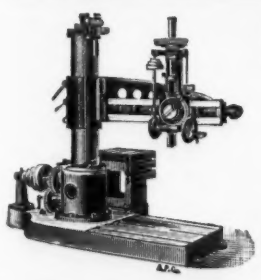

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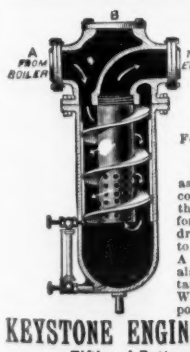

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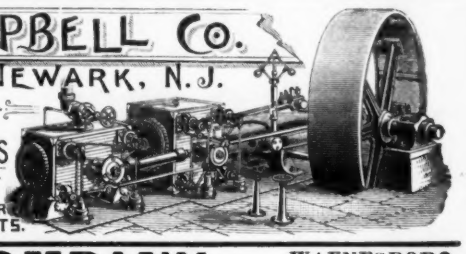

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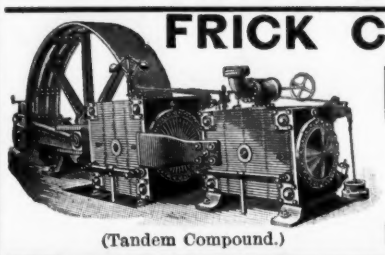

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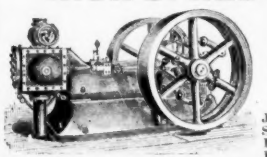

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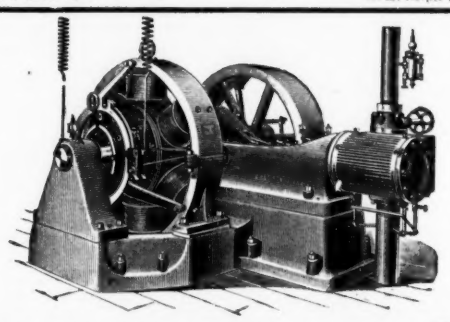

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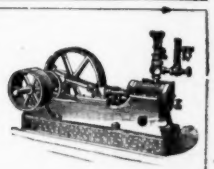

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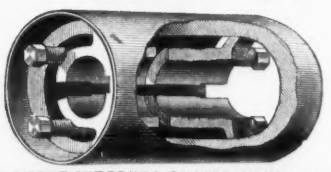

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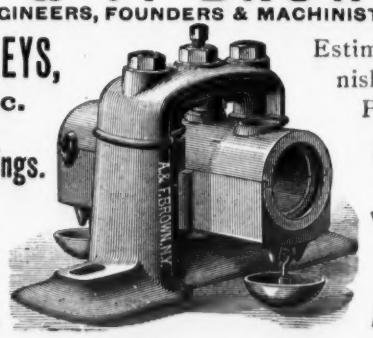

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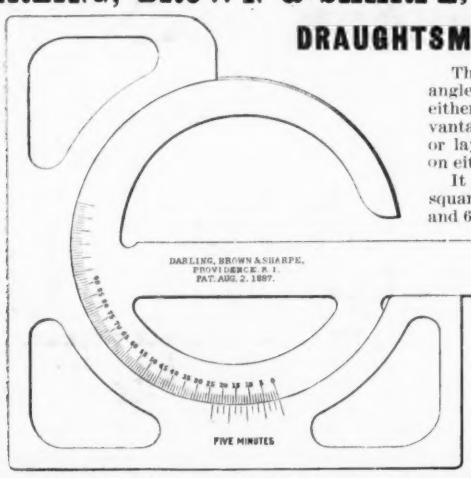

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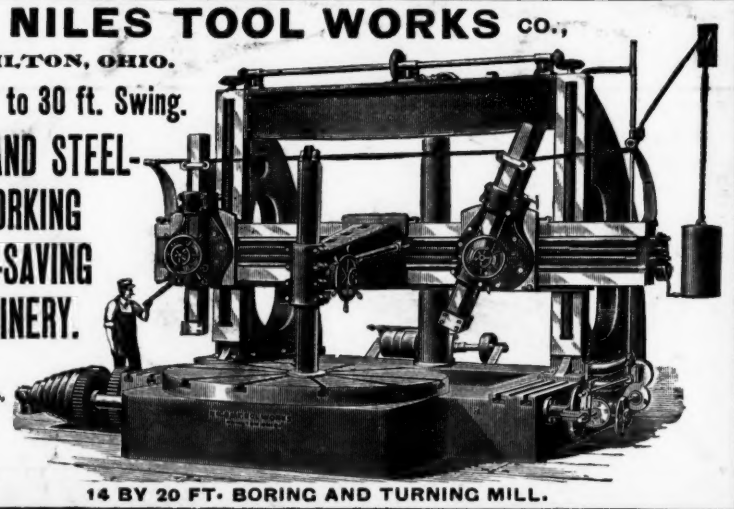

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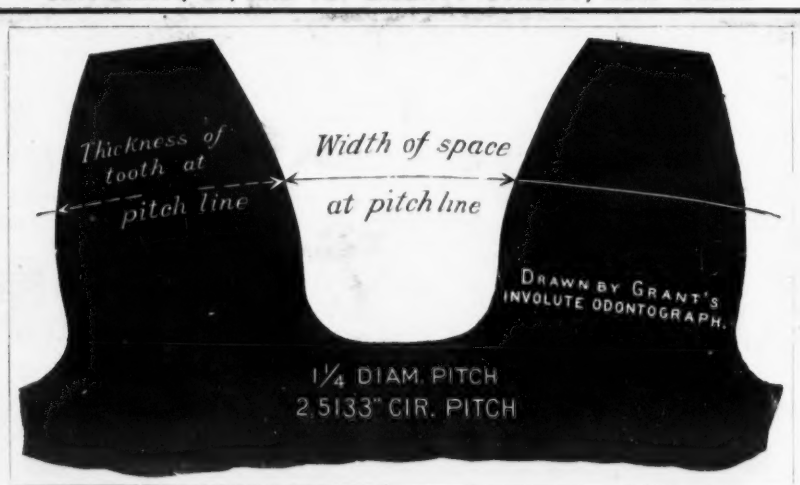
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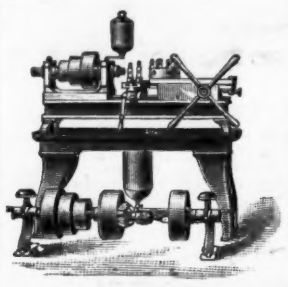

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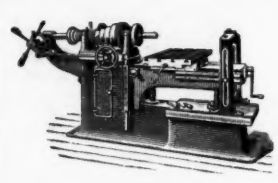

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